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MATTERS RELATING TO COMMITMENTS

FIRST REVIEW OF INFORMATION COMMUNICATED BY EACH PARTY INCLUDED IN ANNEX I TO THE CONVENTION

Compilation and synthesis of national communications from Annex I Parties

Report by the interim secretariat

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Explanatory notes

The following symbols have been used in the document:

Two dots (..) indicate that data are not estimated or reported in the national communication.
A hyphen (-) indicates that the item is not applicable.
A minus sign (-) indicates a deficit or decrease, except as indicated.
A full stop (.) is used to indicate decimals.
(~) before data indicates an approximation.
(≤) indicates that the actual data is equal or below that provided.
(≥) indicates that the actual data is equal or greater than that provided.
References to "dollars" ($) indicate United States dollars.

Details and percentages in tables do not necessarily add to totals, because of rounding.
References to "guidelines" are to the "Guidelines for the preparation of first communications", document A/AC.237/55, annex I, decision 9/2.
References to "IPCC Guidelines" are to IPCC Draft Guidelines for National Greenhouse Gas Inventories.
Text in *italics* under the tables indicates major source/sink categories from the IPCC Guidelines.

The following chemical symbols have been used:

CF_4	Tetrafluoromethane
CFCs	Chlorofluorocarbons
C_2F_6	Hexafluoroethane
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
N_2O	Nitrous oxide
NO_x	Nitrogen oxides
NMVOCs	Non-methane volatile organic compounds
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
VOCs	Volatile organic compounds

The following weights have been used:

Gg	Gigagrams (10^9 grams)
Mt	Megatonnes (10^6 tonnes)

I. EXECUTIVE SUMMARY

1. National communications[1] were received from 15 Annex I Parties in time to be considered in the preparation of this compilation and synthesis. These Parties accounted for 41 per cent of global emissions of CO_2 from fossil fuel combustion in 1990.[2] Three other communications have since been received.

National circumstances

2. Parties emphasized the importance of particular national circumstances. Thirteen Parties mentioned a national target or targets that are supplementary to their Convention commitments. Six of these anticipated that their current or planned policies and measures would achieve their national targets. Several Parties pointed to the evolutionary nature of climate change policy whereby measures are implemented, progress assessed and further measures considered. A number of Parties underlined that they were considering the development and implementation of further policies and measures.

Inventories

3. All reporting Parties communicated a 1990 national inventory of emissions by sources and all but one communicated estimates of CO_2 removals by sinks. All Parties addressed CO_2, CH_4, N_2O and precursors; some provided estimates of other gases, and some used global warming potentials (GWPs) (see tables A.1-A.8). CO_2 was confirmed as being the most important greenhouse gas for the reporting Parties. Fuel combustion was the largest source of CO_2 emissions, with most of these emissions coming from energy and transformation industries and transport. "Managed forests" accounted for most CO_2 removals. The largest source of CH_4 was livestock, with waste a close second. N_2O emissions came largely from agriculture (fertilizer use) and industrial processes.

4. The degree of confidence associated with CO_2 data, in particular from fuel combustion, is high and the estimates are consistent with other authoritative sources. The initial technical analysis of inventories identified information gaps, most often background data or inadequately documented methods. The minimum documentation standards to ensure transparency were not always followed and sufficient information to enable reconstruction of the data was not always provided. A number of potential inconsistencies and difficulties in

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[1] The term "national communications" includes communications from the regional economic integration organization included in Annex I to the Convention and should also be interpreted as including any supplementary information provided to the interim secretariat by Parties.

[2] OECD/IEA, *1994, World Energy Outlook*, OECD, Paris, 1994, p. 90; and 1992 IPCC Supplement - Scientific Assessment of Climate Change, WMO/UNEP, Geneva, 1992, p. 8.

aggregating and comparing inventory data also arose (for example, the use of adjustments to account for climatic conditions or electricity imports) on which guidance is needed.

Policies and measures

5. All reporting Parties are implementing policies and measures to mitigate climate change; most reported actions targeted at the three major greenhouse gases, although the focus was clearly on CO_2. Variations in the level of detail of the descriptions of policies and measures (in particular, the status of implementation and estimates of effects) complicated the synthesis process. The following main policy thrusts emerged:

- Increased competition, improved efficiency and fuel switching in power generation
- Improving the efficiency of industrial equipment and processes
- Improving automobile fuel efficiency, controlling emissions, encouraging public transportation
- Improving energy efficiency in buildings, mechanical systems and appliances
- Reducing emissions from animals and nitrogen fertilizer use
- Preserving forest biomass and encouraging afforestation
- Minimizing waste and reducing emissions from landfills

6. The residential, commercial and institutional, transport and industry end-use sectors appear to be where the Parties were most active. When taking into account the limited information on projected effects of measures, the residential, commercial and institutional sector emerges as a major contributor to expected CO_2 emissions limitations.

7. A wide array of policy instruments were reported as being used. Regulatory activity focused on appliance and industrial equipment standards, vehicle emission standards for precursors, building codes and forest preservation. There was widespread use of economic instruments, although subsidies, rebates and incentives predominated over taxes, except in a few cases; they were used to improve the efficiency of power generation, promote renewable energy and alternative fuels, encourage the use of public transport and promote afforestation. Taxes were most frequently mentioned in the transport and waste sectors, although broadly-based taxes were mentioned by some Parties. Voluntary agreements were mentioned particularly where large industries were involved. Information and education programmes were notable in the agriculture and waste sectors and in regard to consumer choices in most sectors. Most Parties also reported on research and development programmes aimed at developing technologies or practices to reduce emissions, particularly with regard to energy.

8. The significance of international cooperation for climate change policies and measures was noted frequently, particularly when they could potentially affect trade flows.

Projections and effects of measures

9. All Parties provided "with measures" projections. In most cases, they addressed the three major greenhouse gases as well as removals by sink in 2000; in some cases, they also gave projections for other gases and precursors. One Party provided figures for 2005 and not for 2000. Detailed information on projections of emissions and removals is provided in tables 1-7. The projections are not comparable between Parties and the individual national totals have not been added. Nine Parties provided estimates of the total effects of measures, often noting methodological difficulties but no clear conclusions emerged.

10. The projections were developed using different approaches and assumptions, although the latter were in line with those used elsewhere. Most Parties provided enough information to allow for a qualitative understanding of the approaches used, although it was often not clear which policies and measures were reflected in the projections. Some Parties adjusted their base year figures upward for reasons of climatic anomalies or electricity imports.

11. The "with measures" projections reveal a different pattern for CO_2 emissions than for emissions of other gases. **The following observations compare projected figures for 2000 with the 1990 figures used in developing the projections (three of which included "adjustments") rather than with the 1990 inventory figures, since the projections were derived from the former.**

12. For CO_2 emissions (excluding land use change and forestry) (table 1), nine Parties projected an increase to the year 2000 in the absence of additional measures. Five Parties projected stabilization or a decrease for 2000. Another Party projected only a decrease for 2005. Seven Parties projected increased "net" CO_2 removals from the land use change and forestry sector for 2000, two Parties projected stable removals and one Party, decreasing removals. (The main effect of adjustments is shown in table 1.)

13. For CH_4 (table 3), all but two Parties projected decreases. No clear picture emerges for N_2O (table 4). Few Parties provided projections of other gases (table 5), but for those that did, emissions of PFCs were decreasing, while emissions of HFCs were increasing. If IPCC-1994 GWP values are used to aggregate the emission data for all gases, projected emission levels in 2000 were below 1990 levels for five Parties and above for nine Parties (table 6). One Party projected a decrease to 2005. For three of the Parties whose emissions were projected to grow, the increase was less than 2 per cent. If CO_2 removals are included (table 7), then seven Parties project decreases on a CO_2 equivalent basis.

14. In due time, it will be possible to assess the achievement of the aim of returning emissions to 1990 levels by 2000 by comparing the inventory figures for those two years. At

present, a comparison of CO_2 projections for 2000 with inventories for 1990, would suggest a somewhat greater need for additional measures than is indicated by the above analysis.

15. Several Parties stated that their projections, which incorporated current policies and measures, did not necessarily reflect what they expected their emission levels to be in 2000 as they intended to develop and implement further measures.

Finance, technology and capacity building

16. All 14 Annex II Parties that submitted national communications have made commitments to contribute to the replenished Global Environment Facility (GEF); all but one of them contributed to the GEF pilot phase. The level of "new and additional" resources, however, cannot be determined on the basis of the communications as there is no agreed benchmark against which to measure this. Although financing through the GEF is defined in the GEF Instrument as "new and additional", only a few communications indicated explicitly that their contributions to the GEF were "new and additional". All GEF contributions were reported as total contributions to the Facility rather than to the climate change focal area.

17. All Annex II Parties reported on some activities implemented through bilateral, regional or multilateral channels. It was not possible to aggregate the reported resource flows owing to lack of comparable data. Much effort was reported on capacity building, especially as regards country studies and inventories. With regard to adaptation and vulnerability assessment, most of the activities could be characterized as preparatory studies.

18. The discussion on technology transfer centred on approaches and mechanisms for transfer with limited discussion of specific activities. About half of the communications also reported on bilateral and multilateral assistance to countries with economies in transition.

Other commitments and issues

19. All but one communication discussed vulnerability to, and the expected impacts of, climate change. Coastal zone impacts, including sealevel rise, and impacts on the agricultural sector were frequently mentioned. All Parties but one included discussion of adaptation measures and five indicated they were developing or implementing such measures.

20. All communications provided information on research and systematic observation activities. Similarly, all communications discussed education programmes and training related to climate change as well as public participation in responding to climate change.

21. The provisions of Article 4.6 were mentioned by one Party but without making a specific request at this time. Seven Parties discussed joint implementation.

The review and synthesis process

22. The experience of analysing and synthesizing the communications confirmed the usefulness of dialogue with reporting Parties. The in-depth reviews will be important opportunities to obtain a better understanding of the communications and of the actions of Parties to implement the Convention. They should also result in an improved basis for the second synthesis document. The review process has also revealed some aspects of the guidelines for the preparation of communications that would benefit from further work. Time did not permit a systematic review of the guidelines but this could be done by the secretariat for the Subsidiary Body for Scientific and Technological Advice.

II. INTRODUCTION

A. Background

23. The Framework Convention on Climate Change requires each Party included in Annex I to submit, within six months of the entry into force of the Convention for it, information as specified in Articles 4.2(b) and 12. The Intergovernmental Negotiating Committee agreed on guidelines for the preparation of first communications by Annex I Parties ("the guidelines") to promote consistency, transparency and comparability among communications[3] (see A/AC.237/55, annex I, decision 9/2).

24. The national communications began to come due on 21 September 1994. The following 15 Parties submitted their communications to the interim secretariat in time to be considered in the preparation of this document:

Australia	Denmark	New Zealand	Switzerland
Austria	Germany	Norway	United Kingdom of Great Britain and Northern Ireland
Canada	Japan	Spain	
Czech Republic	Netherlands	Sweden	United States of America

These Parties accounted for 41 per cent of global emissions of CO_2 from fossil fuel combustion in 1990.[4]

25. An additional three communications have been received. Those of Hungary and Ireland were submitted before their deadlines but not in time to be considered in the

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[3] See footnote 1.

[4] See footnote 2.

preparation of the present document; that of Monaco was a partial submission. Three Parties required to do so, the European Economic Community,[5] Iceland and Portugal have not submitted communications at the time of writing, although work is in progress. Details regarding the due dates, submission and receipt of the national communications can be found in document A/AC.237/INF.16/Rev.2.

B. The review and synthesis process

26. The Committee requested the interim secretariat to prepare a compilation and synthesis of the national communications for consideration at the eleventh session and for subsequent submission to the first session of the Conference of the Parties (COP 1) (see A/AC.237/76, annex I, decision 10/1). In responding to this request, the secretariat was assisted by experts it selected from nominations submitted by Governments and intergovernmental organizations. All these persons worked with the secretariat in Geneva. In addition, a number of experts served as special advisers on particular subjects. They worked from their offices but travelled to Geneva for meetings.

27. The Governments of China, Cuba, Italy, the Russian Federation and the United States provided experts as did the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA). Special advisers were from Brazil, Finland, Japan, Netherlands and Thailand. A number of consultants were also engaged, with a view to strengthening the secretariat's present capacitiy and obtaining a better geographical balance in the sources of expertise.

28. The review and synthesis process was marked by very strict deadlines with the aim of making the document available in the official languages of the United Nations for the eleventh session of the Committee. The period from 26 September until 4 November 1994 saw an initial technical analysis of the individual communications and the development of synthesized information. In some cases, additional data were requested from submitting Parties; such data were taken into account to the extent possible. A second phase, from 4 November to 2 December 1994, saw the final drafting of the compilation and synthesis. Experts from Governments and organizations were involved principally in the first phase.

29. This compilation and synthesis is part of a broader communication and review process, the basis of which is the national communications themselves. These are the authoritative sources of information on actions by Parties to implement their commitments. Another important element of this process is the in-depth review of each communication. Preparation for these reviews has been initiated and, subject to a decision by COP 1, the

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[5] Now referred to in the United Nations as the European Community.

reviews will continue throughout 1995, leading to reports on individual communications and a revised compilation and synthesis for COP 2. The work undertaken in preparing the present document has resulted in the development of a number of databases and in the generation of substantial amounts of background documentation that will facilitate the in-depth reviews and could form the basis of additional inputs to the COP and the subsidiary bodies.

C. Approach to the document

30. This document synthesizes the information contained in the 15 communications; it is neither a summary nor a country-by-country analysis. It is designed to provide an overview of the implementation of the Convention across reporting Parties, noting trends and patterns, areas of convergence or divergence, data gaps and other appropriate conclusions, including the overall effects of policies and measures. As a technical analysis, it can provide the basis for policy conclusions by the Committee and the COP. Parties are mentioned by name in the tables but not in the narrative text. This was felt to be in the spirit of a "facilitative and non-confrontational" review process. At times, however, the lack of names in the text makes reading cumbersome. The Committee may wish to give guidance on this point for the future.

31. The structure of this document generally follows the indicative outline approved by the Committee at its tenth session (see A/AC.237/76, annex I, decision 10/1) although some adjustments have been necessary to take account of the content of the communications. There are five sections dealing with inventories, policies and measures, projections, finance and technology transfer and other issues. Each section synthesizes the relevant information and identifies some general conclusions. The final section offers some observations on possible follow-up work on the guidelines as a result of the experience gained to date.

32. In view of the different starting points and variety of approaches used by the Parties, the secretariat has attempted to make the information as comparable as possible. In order to do this, it has been necessary to make some judgements on how information from Parties should be presented. In such cases, what has been done is explained in the text or in footnotes. The secretariat has also used a number of different presentational tools. The compilation and synthesis should be seen as a "work in progress" which will be improved with experience and which would benefit from guidance from the Committee.

33. The interim secretariat takes full responsibility for the content of this document. It would, however, like to acknowledge with gratitude the outstanding effort and dedication of the experts who assisted in its preparation. It would also like to thank the Governments and organizations that agreed to lend experts to participate in this exercise.

III. CONTEXT

34. The national communications total over 1,800 pages, not including supporting documentation. They generally included an introductory section which stressed the role that unique national circumstances play in determining the characteristics of emission profiles and the appropriateness of different response strategies. The communications focused on inventories (taking on average 15 per cent of the total length, plus annexes), policies and measures (about 35 per cent), projections (about 10 per cent) and discussions of finance, technology transfer and international cooperation (about 5 per cent). Short chapters were often included on the impacts of climate change, vulnerability and adaptation, research and systematic observation and education, training and public awareness.

35. Parties were requested to address the anthropogenic emissions and removals of all greenhouse gases not controlled by the Montreal Protocol. The overall coverage of the different gases ranged from a focus on CO_2 to a full treatment of all gases. CO_2 was addressed by all Parties in discussions of inventories, policies and measures and projections. Fourteen Parties provided full consideration of CH_4 and 10 Parties provided full consideration of N_2O. Although covered well in the inventories chapter, the ozone precursors were not systematically addressed in the other chapters. Scattered information was provided for some of the other gases (HFCs, PFCs, SF_6). In general, the inventories chapters were the most comprehensive in their coverage of gases.

36. Removals by sinks was discussed only with regard to CO_2. All countries but one reported removals by sinks in their inventory and 10 countries included removals in their projections. All countries reported in varying detail on planned and ongoing policies and measures to address removals by sinks.

37. Consistent with their commitments under Article 4.1(b), 11 Parties specifically indicated that national climate change programmes and/or strategies had been developed. Others indicated that policies specific to climate change were in place. In addition, eight Parties described national committees to coordinate implementation of national commitments.

38. National targets, some of which corresponded to the aim specified in Article 4.2(a) and (b), were reported to have a central role in the development and evolution of national climate change policy. Thirteen Parties specifically mentioned self-imposed quantitative national targets in their communications, some of them had multiple targets. These targets differed considerably among Parties. For example, the gases included varied, the base and commitment years differed and they were expressed in gross, net, or per capita terms. Moreover, many countries specified qualifications or conditions (for example, regarding factors such as neutrality to international trade competitiveness, other Parties taking similar action, developments in international energy markets and progress in negotiations). Of the

Parties mentioning national targets, five could be characterized as having "stabilization" targets (one on a per capita basis), four as having "reduction targets" and four as having some combination of stabilization and reduction.

39. Six Parties mentioned specifically that, based on policies and measures already undertaken or likely to be adopted, they expected to attain their national targets. Four Parties acknowledged that additional measures would have to be taken if their national targets were to be reached. The other communications were not explicit on this point. Most countries described processes in which inter-ministerial committees would assess results achieved with a view to adjusting and further developing policies.

IV. INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS IN 1990

40. Pursuant to Articles 4.1(a) and 12.1(a), all reporting Parties communicated a 1990 national inventory of anthropogenic emissions by sources of greenhouse gases not controlled by the Montreal Protocol. As requested by the guidelines, all Parties, using consistent formats, presented emission estimates on a gas-by-gas basis and addressed the three main greenhouse gases, CO_2, CH_4 and N_2O. All Parties also addressed the ozone precursors (CO, NO_x and NMVOCs) although one Party did not estimate CO and NMVOCs. Nine Parties provided estimates for PFCs, three for HFCs and three for SF_6. All but one Party provided land use change and forestry CO_2 estimates which encompass removals.

41. The guidelines requested Parties to use the IPCC Draft Guidelines for National Greenhouse Gas Inventories ("the IPCC Guidelines") in estimating, reporting and verifying inventory data. All Parties provided a report of their inventory data using the summary table recommended by the IPCC.

A. Presentation of results

42. Tables A.1-A.8 summarizing inventory data for CO_2, CH_4, N_2O, international bunkers, other greenhouse gases and ozone precursors appear in the annex to this document. Each table is accompanied by explanatory footnotes and by a brief analytical overview. As a result of the different ways of reporting used by Parties, it has been necessary to present CO_2 emission and removal data from land use change and forestry separately. This permits the data to be presented in a consistent and coherent manner. Percentage distributions of CO_2, CH_4 and N_2O emissions by source/sink categories are also provided in the form of pie charts.

43. Figure A.4 shows the relative contributions of the different greenhouse gases for each Party, and the aggregate for all Parties, based on calculations using GWP values recently approved by the IPCC (IPCC-1994). Such a presentation can be regarded as a technical contribution to the analysis of inventory results and not as prejudging a decision by the COP on the use of GWPs.

B. Methodological issues relating to the reporting of inventories

1. Transparency

44. In order to ensure transparency, Parties were requested to provide enough information to allow the reconstruction of their inventories from national activity data, emission factors and other assumptions, as well as to assess the results. However, the IPCC minimum documentation standards to ensure transparency in reporting inventory data were not always followed. Ten Parties provided the IPCC standard data tables, which allowed the comparison of aggregate emission factors and activity data. For some source/sink categories this proved sufficient to ensure transparency. However, for other categories the necessary explanations of methods and data used at the level of detail at which the estimates are calculated (including a description of any intermediary calculation involved) were sometimes missing. In general, the more complex methods were less likely to be fully documented or independently verifiable. Insufficient documentation also made it difficult to understand if miscalculation, double-counting, omission or deviation from the IPCC Guidelines had occurred.

45. A preliminary analysis of inventory data indicates that nine Parties have provided enough information to allow for the reconstruction and the assessment of their inventory data related to energy. Because it was not possible to fully assess all the supporting documentation provided by Parties in the time available, the transparency of data for all source/sink categories will be further examined as part of the in-depth reviews.

2. Methodological issues and approaches

46. In general, valuable information on methods and data was provided. This section focuses only on methodological issues of relevance to the Committee and the COP. The wealth of material generated during the technical analysis of inventories could be compiled for further consideration by the Subsidiary Body for Scientific and Technological Advice.

47. Most Parties referred to the IPCC Guidelines when presenting their inventory results to point out that their estimation methods were consistent with, based on, or generally followed, the IPCC Guidelines. Parties also stated that when appropriate to national needs

and capabilities, detailed country-specific methods and data were used. Two Parties used the CORINAIR[6] methodology. One Party only did not document which methods were used.

Energy

48. Data for CO_2 emissions from fuel combustion were consistent with other authoritative sources of country-specific estimates. This confirms the quality and degree of confidence that can be associated with the CO_2 inventory data, despite the problems identified during the technical analysis. Most estimates were within 5 per cent of estimates available from IEA.[7]

49. Parties used two basic approaches to calculate emissions from energy consumption: a top-down approach, as described in the IPCC Guidelines, and a bottom-up sectoral approach. The former was used by eight Parties, the latter by six; for one Party it was unclear which method had been used. For those that used the top-down approach and provided only the IPCC standard data tables, CO_2 emission estimates were not appropriately documented. Elements needed to ensure transparency include detailed information on approaches and methods used, sources of data, treatment of feedstocks, percentage of carbon oxidized, heating values and other assumptions. One Party reported CO_2 estimates calculated using the IPCC recommendations and its own method (the difference was less than one per cent).

50. The treatment of feedstocks was not always documented which made it difficult to assess whether double-counting between the energy, industrial processes and waste categories had occurred. At least one Party departed from the IPCC Guidelines by including CO_2 emissions from biomass fuel combustion in its energy total. This Party explained that it had done so because the biomass material it used was mainly imported.

Land use change and forestry

51. The methods used to estimate emissions and removals from "managed forests" (described by the IPCC as the main category where removals would occur) built on the IPCC default methods. There were two general approaches that should yield similar results:

- Six Parties measured actual biomass increment and harvest, thereby estimating emissions and removals separately (essentially the IPCC default method)

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[6] CORINAIR is the component dealing with air emissions inventories of the European Economic Community Programme CORINE (Coordination d'Information Environnementale).

[7] OECD/IEA, *Climate Change Policy Initiatives, 1994 Update*, vol. I: OECD countries, OECD, Paris, 1994, p. 25.

- Two Parties calculated the difference in total stock between two different points in time, thereby making it technically unfeasible to estimate emissions separately from removals

The other Parties either used quantitative models or did not document their methods.

52. An initial assessment indicates that only five Parties provided the information needed to reconstruct their estimates from this category. There was some confusion on the meaning of listing emissions separately from removals. This needs clarification.

Waste

53. At least three Parties deviated from the IPCC Guidelines by including CO_2 from organic waste combustion or aerobic decomposition of organic carbon in their totals.

Other gases

54. The information provided on PFCs and HFCs was not always given per type of gas; this would be useful in the light of their different GWPs.

3. Level of uncertainty

55. Parties were requested to discuss the level of uncertainty associated with quantitative inventory data, at least qualitatively. Eleven did so by providing information on uncertainty either on a gas-by-gas basis or at the source/sink category level, with four Parties doing so quantitatively. The information provided on the level of confidence by gas may be summarized as follows:

- CO_2: high, except for land use change (low) and forestry (medium)
- CH_4: medium
- N_2O: low to medium
- NO_x: high to medium
- CO and NMVOC: medium to low

Six Parties also provided a self-assessment of the completeness and quality of their inventories using the IPCC recommended format.

4. Inconsistencies/comparability problems

56. When comparing and aggregating results across Parties, the following should be taken into account. Some Parties departed from the guidelines, used different assumptions, defined source/sink categories differently, omitted gases and/or categories included by other Parties or included offshore territories. Three Parties reported their inventory for a fiscal year rather than the 1990 calendar year, with one doing so only for the energy category. More work is needed to assess these elements and determine how the comparability of future inventories can be enhanced.

57. In addition to providing actual emission estimates, one Party also adjusted its CO_2 emission estimate upward to take account of warmer climatic conditions and presented this adjusted figure as the working figure. Five Parties noted that 1990 had not been a normal climatic year but did not adjust their data, although one presented an adjusted emission estimate for information purposes. Another Party adjusted its emission estimates upward to take account of electricity imports. The use of such adjustments raises questions of consistency that require guidance. In the relevant tables in this report, the secretariat has dealt with such cases by presenting the unadjusted inventory figures and addressing the adjustments in a footnote.

5. Additional information provided by Parties

58. The guidelines mention the possibility of presenting inventory information for years subsequent to 1990. Six Parties provided such information for CO_2 emissions, five for CH_4 and four for N_2O. Most provided data for 1991 and 1992, and two Parties also provided some data for 1993. No clear trend in emissions is evident. In most cases, emissions in 1992 and 1993 were not significantly different from emissions in 1990.

59. With regard to the other optional provisions of the guidelines:

(a) Eleven Parties presented information based on the use of GWPs for a time-horizon of 100 years, mainly for CH_4 and N_2O with values given by the IPCC in 1992. IPCC-1990, IPCC-1994 and national GWP values were also used;

(b) Six Parties provided information on historical trends, mainly for CO_2;

(c) Three Parties provided information on a per capita basis, one of which included estimates on a per GDP basis; and

(d) One Party provided estimates for SO_2 and CFCs and related compounds.

C. Summary conclusions

60. CO_2 was confirmed as being the most important anthropogenic greenhouse gas for the reporting Parties. Fuel combustion was the largest source of CO_2 emissions, with most of these emissions coming from energy and transformation industries and transport. No removals for gases other than CO_2 were reported, "managed forests" being the largest carbon removal and reservoir. The largest source of CH_4 emissions was livestock with waste a close second. The largest source of N_2O emissions was agriculture (fertilizer use), followed by industrial processes.

61. The degree of confidence associated with CO_2 data, in particular for fuel combustion, is high and the estimates are consistent with other authoritative sources of information. Where the initial technical analysis of inventories, based on national communications and supporting material, identified information gaps, these involved most often background data that were not provided or methods that were not fully documented. Potential inconsistencies and difficulties in aggregating and comparing inventory data have arisen from the different definitions for source/sink categories and assumptions used, the reporting of removals by sinks, the inclusion of biogenic sources of CO_2 emissions, the omission of categories and gases, the inclusion of data from offshore territories, the reporting for fiscal years and the use of "adjustments". In general, national communications contained enough information to identify such problems. Guidance is needed on how to address these.

62. The review and synthesis of inventory results was facilitated by the existence of guidelines, which Parties made considerable efforts to follow in communicating inventory data. Despite the problems identified above, inventories were the most comparable and consistent sections throughout communications. Progress has been made in understanding problems relating to inventory reporting and in identifying areas for further work. Many of the issues identified could be resolved by bringing more clarity and precision to the guidelines (see section IX below).

V. POLICIES AND MEASURES TO LIMIT ANTHROPOGENIC EMISSIONS AND PROTECT AND ENHANCE SINKS AND RESERVOIRS OF GREENHOUSE GASES

63. All Parties, in accordance with Article 12.2, described policies and measures adopted to implement Article 4.2(a) and (b). The level of detail varied considerably among Parties and, within a single communication, between different policies and measures.

64. The guidelines request that, to facilitate transparency, enough detail should be provided about each policy and measure, including its objective in terms of the gas and sector targeted; the type of policy instrument used; its status of implementation; how it is expected to function and interact with other measures; and indicators of progress.

65. Pursuant to decision 10/1, Parties were invited to identify measures that appear to them particularly innovative and potentially replicable. Two submissions were received. They are reproduced in document A/AC.237/MISC.42, but are not considered in the present document.

A. Approach to the review of policies and measures

66. After a review of all 15 communications, more than 700 policies and measures were identified and categorized in a database according to country, sector, gas and type of policy instrument (economic instruments, regulations and guidelines, voluntary agreements and actions or information, education and training). Information provided on research and development (R&D) activities is consolidated separately (see section C below). The sectoral categorization used is parallel to the IPCC inventory source/sink categories.

67. Overall, any policy or measure identified in a communication was included in the database. As information on the status of implementation, emissions reduction potential, and cost were either not provided or not clear these factors could not be analysed. The secretariat did not seek supplementary information on measures reported, which could mean that some of them may not have been recorded in the relevant categories of the database. Additionally, whenever a Party mentioned that a particular programme was directed at more than one gas or sector, it was recorded as a distinct measure in each instance in the database.

68. Taking these points into account, and the fact that policies and measures were described in different ways and to varying degrees of detail, it must be acknowledged that the data may include some overlaps. More importantly, references to the number of measures must be considered as illustrative in terms of a broad distribution of policies and measures by sector, by gas and by type of policy instrument. **They do not reflect the relative importance of the policies and measures in terms of their mitigation potential**.

69. Taking into account these limitations, the secretariat used the database as an analytical tool for organizing heterogeneous information and identifying general policy trends and orders of magnitude. Efforts will be made during the in-depth review process to verify and enhance data on policies and measures in order to identify the major policy trends being adopted by Parties as well as the policy tools and approaches being used.

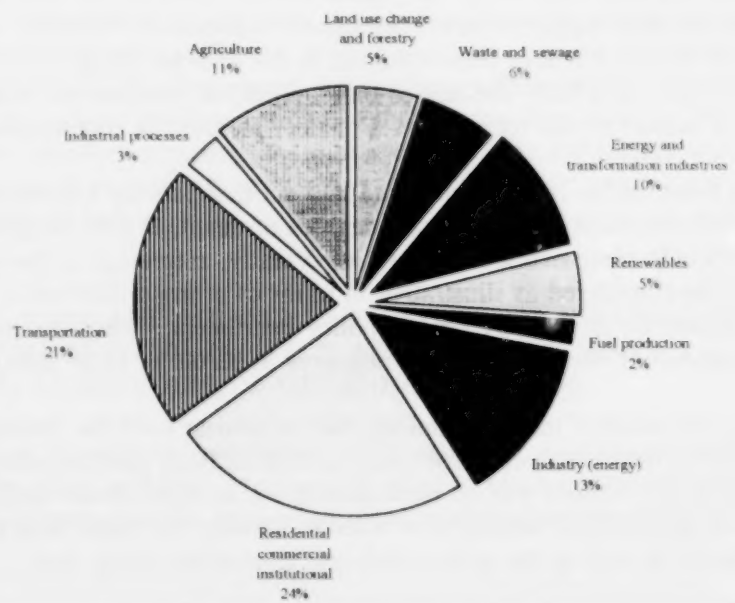
B. Analysis of trends in policies and measures by sector

70. In this section, policies and measures reported in each sector are analysed. For each sector, information is provided on:

- The share of total emissions from the sector based on the inventory data
- The proportion of total measures reported that address emissions in the sector
- The main gases addressed in the sector
- The main aims of the policies and measures, the main policies and measures identified and the types of policy instruments used
- An assessment, where possible, of the relative contribution of measures in individual sectors vis-à-vis the overall emissions reduction efforts of Parties

71. The sectoral analysis which follows synthesizes information reported by 15 Parties. The sectors correspond to the IPCC source/sink categories used in the inventories. The distribution of overall policies and measures by sector is illustrated below:

Figure 1. Distribution of policies and measures by sector



72. Fossil fuel combustion is the largest source of CO_2 emissions accounting for 97 per cent of the total. The bulk of policies and measures reported address this source of emissions and are reflected in the sections dealing with energy and transformation industries, industrial energy end-use and the residential, commercial, institutional and transport sectors. Policies and measures to address emissions of other gases are, for the most part, addressed in the sections on industrial processes, agriculture and waste and sewage sectors.

1. Energy and transformation industries

73. The energy and transformation industries sector includes activities related to the conversion of primary energy to secondary forms and further transformation such as electricity generation, crude oil to petroleum products and district heating. This sector accounted for the largest share of CO_2 emissions from fuel combustion in 1990 (about 38 per cent), as well as small amounts of N_2O and CH_4 emissions. Fossil-fuelled electricity generation accounted for one third to one half of energy-related CO_2 emissions in many reporting countries. A few, however, reported almost no emissions from electricity generation due to a high proportion of hydroelectric and nuclear electricity generation. Thirteen of the communications identified about 75 policies and measures in the sector, of which roughly 80 per cent specifically targeted CO_2 emissions. The communications noted that many measures targeting CO_2 are also likely to reduce emissions of N_2O and precursors.

74. Many of the policies and measures targeted energy efficiency improvements in generation plants through retrofitting existing plants and promoting cogeneration. Ten Parties are pursuing efficiency improvements in electricity generation through improved operation and maintenance programmes and the introduction of advanced combustion technologies such as combined cycle gas plants and cleaner-coal technologies. Many of these policies and measures were identified as cost-effective and are expected to generate both economic and environmental benefits. In implementing these measures, Parties reported the use of a mix of incentives, such as subsidized credit, guaranteed rates and tax incentives as well as regulatory measures.

75. Measures to improve the efficiency of electricity supply focused on integrated resource planning, including optimization of resource use and consideration of all relevant options and uncertainties in the development of utility resource plans. In addition, a few countries reported endeavours to make energy supply industries more efficient by increasing the number of producers and the number of supply options through structural reforms in gas and electricity markets.

76. Twelve Parties identified about 25 measures aimed at promoting the use of renewable sources of energy, nuclear energy and less carbon intensive fuels. Switching to lower carbon

fuels was reported by many Parties to decrease emissions. Some communications explained these initiatives by the fact that their electricity generation mix is primarily based on fossil fuels, in particular, coal. Parties reported renewable energy measures focusing on solar, wind, hydro and biomass. Parties often indicated that renewables could play an important role in the next century, even though their contribution to the reduction of CO_2 emissions in the near future is limited owing to their modest contribution to current energy supply and because of costs. Most of these measures have been implemented with the use of economic incentives, such as low-interest loans, tax incentives and subsidies. A few countries reported measures to improve safety in the use and further development of nuclear power generation.

77. Some Parties noted policies and measures which promote the introduction of more efficient transmission and distribution equipment. Improvements in energy transmission include grid optimization, promotion of district heating and superconducting technology. At the distribution level, policies focused mostly on improving equipment standards, encouraging the use of high efficiency transformers and promoting better operation and maintenance of boilers and gas distribution networks.

78. A few countries identified policies related to energy management techniques being implemented by utilities which aim to reduce and manage load more efficiently and reduce peak power demand. These measures are part of demand side management activities which also include end-use efficiency improvements. Policies and measures to enhance end-use efficiency are discussed in more detail in the residential, transport and industry sections.

79. Six countries mentioned policies to reduce fugitive fuel emissions associated with fossil fuel production such as coal mining and natural gas. Such policies took the form of low-emission guidelines and information programmes to encourage voluntary action.

2. Industry

80. Industry as an end-user of energy accounted for 21 per cent of total CO_2 emissions associated with fuel combustion, 9 per cent of total CH_4 emissions and 3 per cent of N_2O emissions. Approximately 100 policies and measures were reported by the 15 Parties, most being directed at CO_2 emissions.

81. The policies and measures were focused primarily on improving the efficiency of energy consuming equipment and energy efficiency of industrial processes. A large number of the measures aimed at encouraging the development of combined heat and power installations, promoting cogeneration systems and enhancing energy auditing. The demonstration of new technologies was also important in this sector.

82. The use of economic instruments (such as subsidized credit, tax incentives for purchasing energy efficient equipment and pricing and tariff reforms) and the adoption of efficiency standards and guidelines were the most frequently mentioned policy tools used to promote energy efficiency in the industrial sector. Several countries are seeking, or have concluded, agreements with industry to promote voluntary targets for energy efficiency and to engage industries in energy efficiency strategies.

3. Residential, commercial and institutional

83. The residential, commercial and institutional sector accounted in 1990 for about 13 per cent of total CO_2 emissions. These emissions were mainly the result of energy used for space heating and cooling as well as lighting, appliances and mechanical systems. All 15 Parties had policies and measures in this sector accounting for roughly one quarter of all policies and measures (over 170 measures). Almost all of the measures specifically addressed CO_2, although any increase in energy efficiency would also be likely to reduce emissions of other gases. The focus was on energy efficiency improvements of new and old buildings, fuel switching, equipment efficiency improvements and behavioural change. Most of these policies are being implemented through a mix of measures involving economic incentives, regulations and guidelines and information/training activities.

84. Nine Parties specifically mentioned modifying building codes or standards to improve energy efficiency in new construction. Energy audits, customer awareness programmes and energy ratings of new structures were mentioned as means to increase consumer and builder awareness of life cycle energy costs. A similar mix of policies and measures was directed at existing buildings with the principal emphasis on increasing efficiency standards in building energy use. Integrated community planning, programmes for government buildings, and conservation measures such as the installation of individual meters for residential and commercial units were mentioned in many communications. Although fewer countries addressed existing buildings as compared to new ones, a number of countries described subsidy programmes to improve existing structures through renovations, retrofits and mortgage schemes.

85. Nearly all the communications addressed efficiency improvements in mechanical systems or appliances used in residential, commercial and institutional applications. Eight communications specifically mentioned establishing or improving energy standards and codes for mechanical equipment and appliances. Seven communications identified financial incentives (tax rebates, low interest loans or higher loan ceilings) for investment in renewable energy systems in residential, commercial and institutional applications. Buy-backs of inefficient equipment and financial incentives to encourage purchases of energy efficient equipment were also mentioned.

86. Policies and measures to change consumer behaviour were specifically mentioned in most communications, including labelling of appliances, increasing consumer energy efficiency awareness, introducing individual billing and offering technical information and advice to consumers. Other policies and measures were aimed at changing office hours to reduce heating and cooling loads. A few Parties noted the use of broad-based energy taxes.

87. In five of the seven communications that reported specific estimates of emission reductions from individual sectors, the residential, commercial and institutional sectors combined accounted for the largest emission reductions relative to other sectors and 40 per cent or more of the total emissions reductions in each of these five countries.

4. Transportation

88. Transport accounted for 26 per cent of total CO_2 emissions from fuel combustion in 1990 and 15 per cent of N_2O. Several Parties identified the transportation sector as the fastest growing source of emissions. All 15 communications included transport-related policies and measures, which accounted for roughly one fifth of the total. The majority of transportation measures targeted CO_2 emissions, though many will also affect emissions of N_2O and ozone precursors. Transportation measures rely heavily on regulations, particularly for vehicle emission control, and on economic instruments such as fuel taxes. However, a trend towards the use of voluntary agreements in the policy mix, particularly for recent measures, was noted in some communications. The reported transportation policies and measures followed four primary aims: to improve efficiency of individual vehicles, to reduce ozone precursor emissions from all vehicles, to strengthen public transportation and to maximize efficiency in freight transport systems.

89. Improving fuel efficiency to reduce vehicle emissions was listed as a primary objective of most reporting countries. Five Parties are working with vehicle manufacturers to set or improve standards for fuel efficiency, while two other Parties have established fuel economy labels. Two countries mentioned agreements with manufacturers on fuel efficiency targets for 2000. Many Parties reported measures to encourage fuel efficient driving practices and stricter speed limit enforcement. Several communications mentioned taxes at point of purchase or tax incentives linked to vehicle fuel efficiency.

90. The largest number of measures were directed towards vehicle emission control. About half of the Parties described policies and measures designed to curb emissions of ozone precursors, generally through regulations or standards or vehicle inspections.

91. Most countries described policies and measures to encourage a shift from individual cars and trucks to buses, subways, rail and waterway transport. These policies seek to

strengthen public transportation systems by increasing efficiency and passenger convenience. Further, they seek to strengthen the role of public transport in transportation planning and infrastructure development, with about a third of the countries reporting such measures. In most cases, measures to enhance public transportation were being pursued through economic instruments such as direct or subsidized funding of infrastructure development, tax incentives for public transportation use and, in a few cases, through disincentives for vehicle use.

92. Increasing efficiency in the movement of goods was also a focus of transportation measures in about a third of the Parties. In addition to modal shifts from road to rail or waterway, the main aim appears to be improved efficiency of freight hauling through the use of distribution centres, maximizing load capacity, and consolidated intra-urban cargo transport. Loans, subsidies and tax incentives, regulations and guidelines and voluntary actions were all reported.

93. Fuel taxes, carbon taxes or value-added taxes are supportive of the policy thrusts mentioned above and were reported by eight Parties. In a number of countries, fuel tax regimes have been reformed to achieve environmental objectives such as differentiation for carbon content or pollutant characteristics. A few countries noted that a portion of the tax revenue will be used to improve public transportation. A third of the Parties described policies and measures to promote wider use of alternative transportation fuels, primarily through the use of subsidies and tax incentives.

94. Seven Parties provided sectoral estimates of the effects of measures aimed at reducing CO_2 emissions from fossil fuel combustion. For five of these, the estimated effects of measures in the transportation sector make a smaller contribution to projected CO_2 emission reductions than either the residential, commercial or industrial sectors.

5. Industrial processes

95. Greenhouse gases are produced as by-products in industrial processes related to the production of aluminium (PFCs), magnesium (SF_6), nitric acid and fertilizers (N_2O), adipic acid (N_2O), and cement and lime (CO_2). Industrial processes were responsible for 30 per cent of total N_2O emissions and roughly three per cent of total CO_2 emissions in reporting Parties. A small number of policies and measures to address these process-related emissions targeting all the above greenhouse gases were described in six communications. Most of these measures took the form of voluntary agreements with industry, or voluntary action by industry, to reduce emissions from these processes.

96. HFCs also fall into this sector. Only two Parties reported policies and measures to limit HFC emissions -- voluntary agreements to minimize HFC emissions and regulations to phase out a chemical which generates HFC-23 as a by-product.

6. Agriculture

97. The agricultural sector accounted for approximately 38 per cent of CH_4 emissions and 40 per cent of N_2O emissions. All but four national communications mentioned policies and measures to reduce emissions from agricultural practices. Approximately 10 per cent of all policies and measures reported were directed towards this sector. These include roughly a third of all measures addressing CH_4 emissions and a third of measures addressing N_2O.

98. Nine Parties mentioned policies and measures targeted at CH_4 emissions from agriculture, most of which aim to reduce emissions from enteric fermentation by increased efficiency in animal husbandry and to reduce waste by decreases in livestock population. Some countries indicated progress in this area as a result of subsidy reductions or changes in tax systems. Other countries are using a variety of policy instruments, such as information/education programmes to improve livestock productivity. Others reported policies to reduce emissions from animal wastes by improved drainage practices and use of manure for energy.

99. Seven Parties reported policies and measures to limit N_2O emissions from nitrogen fertilizer use by reducing the use of fertilizers through information/education programmes, regulations and economic disincentives or by improving fertilizer application and management.

100. Six national communications described policies and measures to enhance CO_2 sequestration and retention in agricultural soils. A mix of policy instruments were being used to encourage revegetation of fallow and abandoned lands and improved tillage practices.

101. A number of countries also described policies and measures that involve the agricultural sector, but reduce greenhouse gas emissions from fossil fuel combustion. Examples include energy conservation in the agricultural sector and the production and use of biomass energy sources.

7. Land use change and forestry

102. The land use change and forestry sector was reported in 13 communications as an overall sink for CO_2 emissions and an overall source in one. The Parties mentioned about 40 policies and measures, constituting roughly 5 per cent of the total number of policies and

measures. Nine Parties reported on policies and measures that focus on the preservation of biomass in forests. These account for approximately two thirds of the measures described in this sector. Regulations and guidelines related to forest management and conservation made up the vast majority of these policies and measures, while some countries are using economic incentives, information and education programmes towards this end.

103. Ten Parties described policies and measures to encourage afforestation, with emphasis on the use of subsidies and tax incentives. Some noted that the sink enhancement benefits of afforestation would be realized largely over the medium to long term.

104. Six Parties provided specific estimates of expected effects of measures for land use change and forestry in 2000, and five of them also provided specific estimates of the effects of all their policies and measures on CO_2 emissions. In four Parties, measures in land use change and forestry accounted for less than 15 per cent of the effects of all measures on net CO_2 emissions. For two Parties, measures in this sector accounted for approximately 60 and 90 per cent of the projected effects of all measures on net CO_2 emissions.

8. Waste management and sewage treatment

105. The waste management and sewage treatment sector accounted for 34 per cent of CH_4 emissions. About 50 policies and measures (6 per cent of the total number) were reported by 13 Parties; most of these targeted CH_4 emissions. They aimed to promote recycling and minimize waste, reduce emissions from landfills and recover energy from waste.

106. Most countries reported on measures to promote recycling and minimize waste. These were being implemented through regulations, policy guidelines and technical standards. Several countries reported on guidelines to change business practices and lifestyles and promote recycling and waste minimization through, for example, waste management licensing arrangements. Technical standards have been established to regulate packaging and municipal waste management techniques have been introduced. Several countries mentioned waste generation and disposal and some identified taxes (landfill levies, tariffs on wastes) as policy tools to reduce waste volumes. Similarly, voluntary agreements are being sought in many countries to stimulate recycling in households, small businesses and industry. In one country, special agreements with industry on take-back obligations are being implemented.

107. Several Parties reported on policies and measures to improve sewage treatment and reduce methane emissions from landfills, focusing on emission standards for waste incineration plants, the curtailment of landfills and technical standards to reduce their CH_4

emissions. In some cases, financial incentives have been introduced by Parties to promote the development of sewage treatment facilities and support projects to use biogas.

108. Some countries have adopted voluntary agreements to promote recovery of energy from wastes. These measures related mostly to increased recovery of landfill methane for energy production. One country specifically mentioned plans to launch large-scale programmes to reduce CH_4 emissions in this sector. These programmes are expected to make use of voluntary agreements, regulations and research related to landfill use.

C. Research and development

109. Virtually all national communications reported on government-funded research and development (R&D) programmes aimed at developing technologies or practices to reduce greenhouse gas emissions or enhance sinks. In some communications, these programmes were described largely in the chapter on policies and measures while in others they were discussed in a specific chapter on research. For the purposes of the synthesis, these elements are consolidated here. The information provided on these programmes varied widely, ranging from the description of individual research projects to simple outlines of national R&D programmes. Some countries provided information on financial commitments to specific projects and a few provided budget information for entire R&D programmes.

110. With respect to the energy and transformation industries, most Parties reported on R&D efforts in the area of renewable energy sources like solar, wind and biomass. About half of the communications described R&D efforts to improve the efficiency of electricity generation. A few countries highlighted research in nuclear energy. On the energy-use side, virtually all communications described R&D work on technologies to improve the energy efficiency of buildings and energy-using equipment.

111. In transportation, more than half of the communications highlighted R&D on alternative fuels such as biomass-based fuels, natural gas and electric vehicles. Seven countries described R&D under way on transportation infrastructure and management, and a few noted research to improve the fuel economy of passenger vehicles.

112. Few countries reported on R&D related to sink enhancement. More than half of the communications did, however, describe support for R&D of CO_2 disposal or CO_2 fertilization. In the waste area, about half of the communications described R&D for landfill CH_4 recovery for energy purposes. Only a few countries mentioned research in the area of recycling. In the agricultural sector, one third of the communications described R&D work to improve management of fertilizers and soils. A few countries mentioned research into the reduction of methane emissions from animals.

113. Virtually all countries also included a brief discussion of socio-economic research in their communications. For the most part, the research described relates to the identification of emission reductions associated with various policy responses to climate change. A few countries also mentioned research into issues surrounding policy implementation such as the role of behavioural change in energy efficiency programmes.

D. Measures under consideration or requiring international cooperation

114. Twelve Parties referred to the need for a degree of coordination in the implementation of policies and measures to limit greenhouse gas emissions so as to avoid market distortions, particularly with respect to international competitiveness. Two Parties pointed to the potential adverse effects of unilateral measures. CO_2 and energy taxes, product eco-labelling and standards (for example, on catalytic converters, large combustion plants and buildings) were the policy tools most frequently mentioned in this regard. These references are also pertinent to the implementation of commitments under Article 4.2(e) and (i).

115. A number of Parties that belong to the European Community suggested that this organization is an effective mechanism for achieving international cooperation and for advancing coordinated efforts towards the implementation of measures. Five Parties referred to a CO_2 and energy tax and their preference for its implementation through the European Community. One country referred to a specific exemption of electricity generating industries from a domestic CO_2 tax pending international coordination regarding taxation on energy. Four other Parties described measures such as product standards and product labelling which were introduced in the framework of the European Community.

E. Summary conclusions

116. All reporting Parties are implementing policies and measures to mitigate climate change and each Party reported policies and measures targeted at CO_2 and CH_4. The majority of Parties are planning or are implementing policies and measures which target all the major emission source categories. Carbon dioxide is the main focus of attention.

117. Some communications followed the guidelines by providing detailed descriptions on a measure-by-measure basis by gas and by sector; others provided only a broad overview of policies and measures. The absence of detailed information, particularly with regard to the status of implementation, the effects of individual measures, monitoring progress, and interactions among measures made aggregation difficult and constrained the results.

118. Inventories of reporting countries show that CO_2 from the energy sector is the largest source of greenhouse gases. Energy-related policies and measures received significant

emphasis across the communications. These measures were directed at energy production and distribution and at end-use in the residential, commercial, industrial and transportation sectors. Efforts to improve the efficiency of electricity supply and some fuel conversion were commonly mentioned. Increased energy efficiency is a key element of climate change mitigation strategies. Energy-related R&D was prominent.

119. The residential, commercial and institutional, transport and industry end-use sectors appear to be where the Parties were most active. When taking into account the very limited information on projected effects of measures, the residential, commercial and institutional sector emerges as making a major contribution to expected CO_2 emissions limitations. Transportation is a growing source of greenhouse gas emissions. Policy trends indicated in communications show a continuing emphasis on reducing emissions through regulation and on encouraging fuel efficiency improvements for individual vehicles. Voluntary agreements appear to be of increasing interest for transportation measures.

120. All Parties included some sink enhancement measures, with two of these reporting the bulk of their expected reductions from these efforts.

121. Communications highlighted the significance of international cooperation for climate change policies and measures, particularly when they could potentially affect trade flows.

VI. PROJECTIONS AND EFFECTS OF POLICIES AND MEASURES

122. Pursuant to Article 4.2 and the guidelines, all Parties provided projections for anthropogenic emissions. In most cases, projections were provided for the three major gases as well as removals by sinks. In some, projections were also provided for other gases and precursors. One Party provided figures for 2005 rather than for 2000.

123. Several Parties stated that their "with measures" projections, incorporating current policies and measures, did not necessarily reflect what they expected their emission levels to be in 2000 since they intended to develop and implement further measures. The projections provide information on progress made towards the aim specified in Article 4.2 but should be seen in the context of statements on national targets, monitoring of progress and further development of policies and measures.

124. The sections of the communications dealing with projections and effects of policies and measures were very heterogeneous. In an effort to present the information as concisely as possible and in accordance with decision 10/1, the data are set out in tables 1-7. However, **it is important to emphasize that projections from one country are not**

comparable with those from another because of differences in modelling approaches, key input assumptions, sources projected, the representation of policies and measures, the uncertainties of projections due to national circumstances and adjustments in some of the 1990 levels for temperature anomalies or electricity trade. As one communication noted: "... the most useful way to interpret the numerical values quoted in this chapter is to obtain an appreciation of the order of magnitude of the issues. That is, to draw out their qualitative inferences rather than to apply a rigorous mathematical analysis" (emphasis added).

A. Approaches used and methodological issues

125. Parties used different approaches to estimate their projected emissions, reflecting variations in economic structure, experience and data availability. "Top-down" economic models played a dominant role for CO_2 projections. Some countries based their projections on sectoral models, typically for the energy and transport sectors. Some Parties combined "top down" models with more technologically explicit "bottom-up" approaches. It is well known that the use of different models can generate significantly different outcomes. Projections of emissions of non-CO_2 gases and of removals by sinks were, in general, based on more disaggregated approaches. Most Parties provided enough information to allow a third party to obtain a qualitative understanding of the approaches used.

126. It was often unclear how relevant policies and measures were reflected in the projections. In general, the approaches used did not allow complete representation of all policies and measures to the level of detail in which they had been implemented. In part, this is because there is insufficient information on the effects of some policies and measures. In addition, the level of aggregation in some types of models was high. Several Parties noted that such aggregation made it difficult to account for any overlap and synergies between different policies and measures.

127. Important assumptions in developing projections related to gross domestic product (GDP) growth, energy prices and structural changes in energy demand and supply. Eleven Parties gave information on their assumed GDP growth rates for 1991-2000. These ranged from 0.8 to 3.8 per cent per annum, which is in line with projections from OECD[8] (1.9-3.0 per cent for 1991-2000) and World Energy Council (2.4 per cent for 1990-2000). Twelve countries reported their assumptions for real energy prices on world or regional markets: all 12 for oil prices, four for coal and/or gas. With respect to world oil prices, three countries assumed "low" prices in 2000 ($17-20 per barrel), five assumed "moderate" prices ($22-24)

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[8] See OECD, *Economic Outlook*, OECD, Paris, 1993; and *Energy for Tomorrow's World*, World Energy Council, Kogan Page, London, 1993.

and four assumed "high" prices ($27-30). These figures are in line with the IEA World Energy Outlook ($27.3 for the reference case and $20 as an alternative assumption).

128. Various types of uncertainties related to natural variations and policy choices were reported by several countries. A few Parties provided sensitivity analyses of variations in some key inputs. Some also raised issues such as temperature variations, electricity trade, choices of fuels (especially for electricity production), precipitation (for hydro power availability), changes in behaviour, uncertainties in emissions factors (inventories) and in the effects of policies and measures.

129. Several Parties noted that 1990 was warmer than normal. One Party adjusted its inventory and the starting point for the projections. Another Party adjusted only the starting point for its projections in the same way, and two gave quantitative indications of what such an adjustment would have meant for them.

130. Several Parties mentioned electricity trade in relation to projections. One country accounted for its net imports of electricity in 1990 by simulating production of that electricity from available plants within its own borders; another stated that it had accounted for net electricity imports in its 2000 projection without attaching emissions to it, and yet another stated that emissions generated for exported or imported electricity were not taken into account.

131. The Parties that used adjustments did so transparently and expressed the view that, as conditions in projected years were assumed to be average, the adjustments made it easier to demonstrate how policies and measures influenced emissions.

B. Projected anthropogenic emissions and removals in 2000

132. All Parties provided information that constituted, or could be interpreted as, "with measures" projections for CO_2 emissions. Most Parties incorporated in their 2000 figures, to the extent possible, the effects of policies and measures that were implemented or committed to when the communication was produced, often assuming that current funding levels would be continued. Some assumed only partial implementation of action plans/mitigation programmes, while others assumed full implementation and funding of planned activities. One Party included fewer policies and measures in its projections than had already been implemented. In some cases, projections were made for only a part of the economy. Some Parties did not include a "with measures" projection, but provided a "without measures" or "reference" projection and estimated the effects of policies and measures on emissions separately, enabling a "with measures" 2000 level to be ascertained.

133. Some Parties reported difficulties in projecting non-CO_2 gases, often because of lack of data. This has implications for the quality of the projections, particularly for emissions of FCs, PFCs, and SF_6. Several projections of non-CO_2 gases and of removals by sinks, reflected scenarios that incorporated few policies and measures or none.

134. Tables 1-7 below allow the reader to compare, for each Party, the projected emission and removal levels in 2000 with:

(a) The 1990 levels used in developing the projections; and

(b) The 1990 levels reflected in the inventory (see section IV).

Separate tables are provided for CO_2 excluding the land use change and forestry sector (table 1), CO_2 from this sector including removals by sinks (table 2), CH_4 (table 3), N_2O (table 4) and other greenhouse gases (table 5). To give a more effective presentation for "other gases" the figures for PFCs and HFCs are presented using the IPCC -1994 GWP values (100 years time-horizon). Without prejudging the decision of the COP on the use of GWPs, the secretariat has developed GWP-based summary tables for all gases with and without land use change and forestry (tables 6 and 7). The footnotes and notes should be treated as integral parts of the tables; they describe the projections used by each Party and explain any changes or calculations made by the secretariat. **The projections are not comparable and, in accordance with decision 10/1, individual national totals are not added.**

135. The tables reveal some differences between the 1990 levels from the inventories and the 1990 levels used as the basis for the projections. These reflect differences due to rounding, calibration of models, updating of inventories subsequent to the projections being developed, and the fact that some did not include exactly the same sources in the projections as in the inventories. In three cases, such differences also reflect the use of adjustments. For CO_2 emissions, in order to enhance comparability and transparency, it was necessary to include two columns for percentage variations (table 1). For non-CO_2 gases and the land use change and forestry sector, one column for percentage variation sufficed as any differences between comparable figures were minor. In the case of tables 6 and 7, the projections for all gases reflected, for the most part, only subsets of the inventory or other inconsistencies were reported. Thus any comparison between the projection and inventory figures would be inappropriate.

Table 1. Projected anthropogenic emissions of CO_2 (excluding land use change and forestry)
(Gigagrams)

	Data from inventory	Data from projection		Variations	
	1990 level[a] (Gg)	1990 level[b] (Gg)	2000 level[c] (Gg)	from inventory (Percentage)	from projection (Percentage)
Australia	288 965	288 965	336 199	16.3	16.3
Austria	59 200	59 900	65 800	11.1	9.8
Canada	457 441	461 200	510 000	11.5	10.6
Czech Republic	169 514	163 584	135 536	-20.0	-17.2
Denmark	52 100	58 353	53 753	3.2	-7.9
Germany	1 012 443	1 032 000	..	-	-
Japan	1 173 360	1 173 000	1 200 000	2.3	2.3
Netherlands	167 600	174 000	167 600	0.0	-3.7
New Zealand	25 530	25 530	29 550	15.7	15.7
Norway	35 533	35 400	39 500	11.2	11.6
Spain	260 654	222 908	276 523	-	24.1
Sweden	61 256	61 300	63 800	4.2	4.1
Switzerland	43 600	45 400	43 800	0.5	-3.5
UK	584 078	586 720	586 720	0.5	0
USA	4 957 022	5 012 789	5 163 136	4.2	3.0

[a] Data from inventory table A.1.
[b] Minor differences in 1990 levels between inventories and projections are, for example, due to late revisions of inventories, rounding, calibration of models, or that only a subset of the sources were projected. For three countries differences are also due to adjustments.
[c] "With measures" levels for 2000.

Notes*

Australia: The effect of measures in 2000 (table 6.2, p.74) was subtracted from the reference scenario (table 6.1, p.72) reflecting "delayed or partial implementation, and/or other conditions which reduce the probability of effectiveness. This scenario can be taken to be close to the current rate of implementation" (p.74). In general, Australia assumes existing measures to continue at the current rate of implementation (p.80). Fiscal years are used.

Austria: The 2000 figures are from the Institute of Economic Research (IER) reference scenario. Process emissions are assumed stable (footnote, p.2) and added to pyrogenic emissions. The communication states that the scenario does not represent all policies and measures implemented or committed to; these are not fully quantified and may permit Austria to "stabilize its CO_2 emissions by the time period around 2000 to 2005" (p.4). The scenario includes structural shifts in industry away from energy intensive primary industries, sustained efforts to improve energy utilization (generating 1.5 per cent energy efficiency improvement per annum) and preferential treatment of less environmentally damaging and renewable resources as opposed to fossil fuels (p.82).

Canada: Projections (table 13.11, p.128) incorporate "the effects of a number of federal and provincial policies, programs and measures currently in place or in the process of implementation" (p.128).

Czech Republic: The figures for 2000 were calculated from percentage decreases projected (12.3 per cent) and additional information (p.14). Estimate of effects of policies and measures implemented (p.27) was subtracted from a scenario described as assuming "slow implementation of measures, or not at all" (p.13).

* All references in parentheses are to the national communication.

Denmark: Figures were taken from table 3.2, p.41 of the communication, noting that slightly revised figures were given on p.75. Assuming *energy* measures (Energy 2000 Follow Up = 1993) yet to be implemented, and current policies in other sectors. The projection figure used for 1990 is adjusted for electricity imports.

Germany: For 2005 the level was projected to be 980,000 Gg (table 6.15, p.144). (The communication does not specify which measures are included in the projection for 2005).

Japan: The projection is based on the Long-term Energy Supply and Demand Outlook. The projection assumes that "all energy conservation measures incorporated in the Outlook are fully implemented" (p.140) and control measures in *industrial processes* and measures to reduce CO_2 emissions from municipal waste are fully implemented (e.g. waste projection is "based on the assumption that serious efforts will be made to thoroughly recycle paper waste" (p.141)). Fiscal years are used.

Netherlands: The projection takes into account the effects of policies and measures decided prior to the communication being submitted (Energy Policy Scenario, p.59). The 1990 projection figure includes a temperature adjustment.

Norway: The projection reflects "current policies" (p.36) , including carbon taxes that were implemented in 1991.

New Zealand: The figures for 2000 were given as an interval (29,160 - 29,940 Gg, table 7.1, p.46). The measures included in the projection are not specified.

Spain: The projection only takes into account *energy*. It is based on the reference scenario from the Plan Energético Nacional 91 (PEN 91), and when the effects of measures contained in the Plan de Ahorro y Eficiencia Energética (PAEE) (described in the communication), were taken into account, the projected increase of emissions of CO_2 were reduced from 45 per cent to 25 per cent in 2000 from the 1990 level (p.91). Actual development has not been in line with the assumptions from PEN 91; GDP growth especially has been lower. A revision is therefore envisaged.

Sweden: The projection is based on political decisions made to date (p.63), except changes to energy taxes as from 1 July 1994, before which date the forecasts were made. Sweden notes that if temperature adjustments of 3 $MtCO_2$ in the figures for 1990 had been made, projected emissions would have been stable (p.68).

Switzerland: Bunker fuels (2.1 $MtCO_2$ in 1990 and 2.5 $MtCO_2$ in 2000) are subtracted from the aggregate figures given in the report. The projection includes only measures already implemented or decided as of 1994 (pp.18-20, 74, 152). The inventory figure for 1990 was not adjusted for temperature (p.38), but the projection is based on a temperature-adjusted 1990 level of emissions (p.79).

UK: The "central growth/low fuel price" scenario (among several) is presented as the reference scenario for emissions. This includes an agreement with electric utilities on fuel choice and use of CHP after 1990 (p.17). In this projection emissions increased 10 MtC. The measures in place are estimated to reduce emissions in 2000 by 10MtC, which is subtracted from the projected 2000 level (p.16) and used for the table.

USA: The projection includes policies and measures proposed by the Administration in the Climate Change Action Plan (technical supplement to the communication, pp.33-60), assuming "that the funding required will be committed" (technical supplement, p.55). The communication notes that some actions which "may yield significant reductions" are not included (p. 187), while economic growth has been more robust and oil prices lower than assumed.

Comments

All communications gave projections for CO_2 emissions, although some of them addressed only emissions from energy use of fossil fuels and one of them did not give figures for 2000. Nine Parties projected an increase from 1990 levels in 2000, according to the starting points of their projections, while five Parties projected either stabilization or a reduction from that level. The Party that did not provide 2000 figures projected a 5 per cent decrease from 1990 to 2005. The projected growth in emissions is above 10 per cent for five Parties. Among the Parties that projected declines, all but one projected reductions of less than 8 per cent. The exception was an economy in transition whose projected emissions reached the lowest level in 1994 and then started to rise. If projected 2000 emissions are compared with 1990 inventory figures for the three Parties that made adjustments, the results change from projected decreases for all of them to stabilization, a 0.5 per cent increase and a 3.2 per cent increase.

Table 2. CO_2 projections in land use change and forestry[a] (Gigagrams)

	Data from inventory	Data from projection		Variations
	1990 level[b] (Gg)	1990 level[c] (Gg)	2000 level[d] (Gg)	from projection (Percentage)
Australia	130 843	130 843	118 592	-9.4
Austria	..	..	..	..
Canada	-282	..	..	..
Czech Republic	-2 280	-2 300	-2 800	-22.8
Denmark	-2 600	-2 600	-2 600	0.0
Germany	-20 000	..	..	..
Japan	-90 000	-90 000	-92 000	-2.2
Netherlands	-120	-120	-920	-666.7
New Zealand	-16 716	-16 716	-25 519	-52.7
Norway	-12 200	..	..	..
Spain	-4 178	..	..	..
Sweden	-34 368	-34 000	-29 000	14.7
Switzerland	-5 244	-5 200	-5 300	-1.9
UK	-7 284	-9 167	~ -9 167	~ 0
USA	-436 000	-476 710	-539 049	-13.1

[a] Negative values in Gg denote removal of CO_2. Positive values denote net source of emission. Negative values in percentage denote more removals in 2000 than in 1990, or a decrease in net emissions.
[b] Data from inventory table A.3.
[c] Differences in 1990 levels between inventories and projections are, for example, due to late revisions of inventories, rounding, or that only a subset of the sources were projected.
[d] "With measures" levels for 2000.

Notes*

Australia: The effects of measures on biosphere CO_2 (table 6.2, p.74) are subtracted from the "without measures" scenario (table 6.1, p.72).

Czech Republic: It is assumed that the emissions and removals are stable from 1990 to 2000 in a reference case, and the effects of policies and measures in *agriculture* and forestry (p.77) are then subtracted from that level.

Netherlands: The figure for the 2000 level was calculated adding the 1990 level to the estimated effects of measures (p.59).

UK: The projection figure for 1990 only refers to carbon removal from managed forests, which is a subset of the sector. These removals are likely to remain stable (p.37).

USA: The figures assume that sinks represent carbon removals from *land use change and forestry* (technical supplement to the communication, p.8).

Comments

Ten Parties provided separate projections for *land use change and forestry* including removals by CO_2 sinks in 2000. Nine Parties projected an increase in the carbon stored in their biomass reservoirs, basically in forests. Six Parties projected an increase in this net sink; for two Parties it remained unchanged, and one Party projected a decrease. Another Party, reporting this sector as a net source, projected a decrease for 2000. In several cases these projections may include carbon sequestration or mitigation efforts in *agriculture*. Some of the Parties expressed their preference for presenting an aggregate figure for all sectors of CO_2 sources and sinks.

* All references in parentheses are to the national communication.

Table 3. Projected anthropogenic emissions of CH_4 (Gigagrams)[a]

	Data from inventory	Data from projection		Variations
	1990 level[b] (Gg)	1990 level[c] (Gg)	2000 level[d] (Gg)	from projection (Percentage)
Australia	6 243	6 244	6 480	3.8
Austria	603	~ 600	~ 600	~ 0
Canada	3 143	1 136	1 291	-
Czech Republic	877	623	511	-18.0
Denmark	406	406	354	-12.8
Germany	6 218	6 200	..	-
Japan	1 377	1 380	1 150	-16.7
Netherlands	1 067	1 067	786	-26.3
New Zealand	2 112	2 051	≤ 1 931	-5.9
Norway	289	291	278	-4.5
Spain	2 143	..	..	-
Sweden	329	329	300	-8.8
Switzerland	274	274	256	-6.6
UK	4 821	~ 5 000	4 400	≤ -10.0
USA	27 000	27 669	22 335	-19.3

[a] Figures provided in CO_2 equivalent and in MtC have been converted.
[b] Data from inventory table A.4.
[c] Differences in 1990 levels between inventories and projections are, for example, due to late revisions of inventories, rounding, calibration of models, or that only a subset of the sources were projected.
[d] "With measures" levels for 2000.

Notes•

Australia: The effects of measures are subtracted (table 6.3, p.76) from the reference "without measures" scenario (table 6.1, p.72) to obtain a "with measures" projection.

Austria: This is a "without measures" projection (p.88).

Canada: The 1990 projection figure only refers to energy-related emissions. In the 1990 inventory these were 1,085 Gg (table 13.11, p.128).

Czech Republic: Three major sources were projected covering 71 per cent of the inventory figure for 1990 under the assumption that measures will be implemented slowly or not at all (p.14).

Germany: For 2005 the figure was 3,250 Gg (table 6.11, p.142).

Japan: The projection only takes into account the effects of energy conservation and waste reduction measures (table 4-4-1, p.143).

Netherlands: The projection only takes into account the effects of policies initiated under the Second National Environmental Policy Plan (NEPP2) and the Second Memorandum on Energy Conservation (p.164).

New Zealand: The 1990 projection figure does not include energy-related emissions or emissions from *land use change and forestry*. In the 1990 inventory, all other emissions amounted to 2,051 Gg.

Comments

Fourteen Parties gave projections for CH_4. Some projected energy-related emissions only while one Party excluded these. Twelve Parties projected figures at or below 1990 levels for 2000, and one projected an increase. Another one projected an increase of 13.6 per cent, but only for one third of its emissions. The Party that did not give 2000 figures projected a 48 per cent decrease from 1990 to 2005.

• All references in parentheses are to the national communication.

Table 4. Projected anthropogenic emissions of N_2O (Gigagrams)[a]

	Data from inventory	Data from projection		Variations
	1990 level[b] (Gg)	1990 level[c] (Gg)	2000 level[d] (Gg)	from projection (Percentage)
Australia	60.2	60.1	61.1	1.5
Austria	4.8	~ 4.2	~ 4.2	~ 0
Canada	91.2	47.0	51.9	-
Czech Republic	41.0	..	..	-
Denmark	10.2	10.5	11.5	9.5
Germany	223.0	220.0	..	-
Japan	47.3	47.0	~ 52.0	8.3
Netherlands	59.6	59.6	62.2	4.4
New Zealand	8.3	..	..	~ 0
Norway	15.6	15.6	16.3	4.5
Spain	94.7	..	..	-
Sweden	15.2	15.2	13.0	-14.6
Switzerland	28.6	0.9	1.5	-
UK	109.0	~ 110	~ 30	~ -72.7
USA	411.4	529.7	421.0	-20.5

[a] Figures provided in MtC equivalents have been converted.
[b] Data from inventory table A.5.
[c] Differences in 1990 levels between inventories and projections are, for example, due to late revisions of inventories, rounding, calibration of models, or that only a subset of the sources were projected.
[d] "With measures" levels for 2000.

Notes•

Australia: The effects of measures are subtracted (p. 76) from the "without measures" scenario (p.72) to get a "with measures" figure.

Austria: This is a "without measures" projection (p.88).

Canada: The 1990 projection figure only refers to energy-related emissions. In the inventory for 1990 these were 47.6 Gg (p.128).

Germany: The figure for 2005 was 170 Gg (table 6.11, p.142).

Japan: The projection figure for 2000 only refers to the effects of energy conservation and waste reduction measures (p.144).

Netherlands: The projection figure for 2000 incorporates the effects of policies and measures initiated under NEPP2. However, a number of policies implemented to reduce N_2O emissions associated with fertilizer application and animal manure are not incorporated because of a lack of knowledge about their effects (p.65).

Switzerland: The projection figure covers only a minor part of the sources (from transportation) and does not allow for calculation of trends (p.80).

Comments

Twelve Parties gave projection figures for N_2O, one Party provided figures covering only a minor part of the emissions in 1990 and another Party provided only 2005 figures. However, the uncertainty levels are significant. Emissions from five Parties are projected to be either stable or decreasing (by 15 to 20 per cent), while emissions from another four are projected to be increasing (by 0 to 13 per cent) from 1990 to 2000. One Party projected an increase of 10.4 per cent but only for energy-related emissions. Two Parties, one in its 2005 figure, projected major decreases (due to closing old adipic acid plants).

• All references in parentheses are to the national communication.

Table 5. Projections for other greenhouse gases[a]
(CO_2 equivalent in Gigagrams, using 1994 GWPs, time-horizon = 100 years)[b]

	1990 level			2000 level			Variations		
	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6
	(CO_2equivalent in Gg)			(CO_2equivalent in Gg)			(Percentage)		
Australia	..	4 100	..	..	1 700	..	-	-59	-
New Zealand	..	700	..	..	700	..	-	~ 0	-
Norway	0.4	2 500	2 300	600	1 700	800	≥ 0	-32	-65
Sweden	0	400	1 000	2 600	400	1 000	≥ 0	~ 0	~ 0
UK	..	2 100	..	..	~ 100	..	-	-95	-
USA	67 500	17 000	..	120 300	9 700	..	78	-43	-

[a] The figures are rounded.
[b] Figures provided on a weight basis have been converted.

Notes

Australia: Estimates of effects of measures were subtracted from the baseline scenario (table 6.5, p.79). The same split between CF_4 and C_2F_6 was assumed in 2000 as in 1990 (table 6.1, p.72), making it possible to recalculate from other GWPs.

New Zealand: Emissions of PFCs of 0.1 Gg were reported, largely from aluminium smelting. The secretariat has assumed that approximately 95 per cent was CF_4 and 5 per cent C_2F_6.

Norway: The same split between CF_4 and C_2F_6 was assumed in 2000 as in 1990, making it possible to recalculate from other GWPs.

UK: The lowest scenario (reported as most likely) has been chosen.

Comments

Projections for all or some of the other gases (PFCs, HFCs and SF_6) were provided by six Parties. It was only possible to present these uniformly by using GWPs (IPCC-1994). Three Parties projected increases in HFCs as they are replacing ozone depleting substances. Four Parties projected a substantial decrease in PFCs (already achieved by two of them in their 1993 inventories), while two gave a stable projection. Two Parties provided projections for SF_6, one showing a considerable decrease, the other remaining stable.

* All references in parentheses are to the national communication.

Table 6. Projected anthropogenic emissions of all greenhouse gases[a] (excluding land use change and forestry)
(CO_2equivalent in Gigagrams, using 1994 GWPs, time-horizon = 100 years)[b]

	Data from inventory	Data from projection		Variations
	1990 level (CO_2 equivalent in Gg)	1990 level[c] (CO_2 equivalent in Gg)	2000 level (CO_2 equivalent in Gg)	from projection (Percentage)
Australia	465 885	465 909	516 822	10.9
Austria	75 567	~ 74 600	~ 81 886	~ 9.7
Canada	564 805	504 542	558 757	10.7
Czech Republic	204 861	178 848	148 056	-17.2
Denmark	65 413	71 765	66 221	-7.7
Germany	1 238 374	1 256 500	..	.
Japan	1 222 607	1 222 650	~ 1 245 336	~ 1.8
Netherlands	213 377	219 810	207 383	-5.7
New Zealand	80 713	76 480	77 560	1.4
Norway	52 595	52 478	54 790	4.4
Spain	341 208	222 908	276 523	24.1
Sweden	75 739	74 383	75 440	1.4
Switzerland	59 883	52 394	50 567	-3.5
UK	740 263	~ 747 620	~ 704 520	~ -4.2
USA	5 838 784	5 949 981	5 979 274	0.5

[a] Figures from tables 1, 3, 4 and 5 have been used as the starting point for these projections. Only gases and sources that were projected are included.
[b] Figures differ from those in the communications where countries did not use IPCC-1994 GWPs (time-horizon 100 years).
[c] Major differences between inventory figures and projection figures for 1990 reflect that projections were not given for all gases reported in the inventories or for all sectors, nor that temperature or electricity imports adjustments had been taken into account.

Comments

When all emissions (outside *land use change and forestry*) are totalled for each country using IPCC-1994 GWPs, nine Parties projected increases, four of them less than 2 per cent. Five Parties projected to be below 1990 levels by 2000. The Party that did not give figures for 2000 projected an 11 per cent decrease from 1990 to 2005. This is based on adjusted figures, though the adjustments would have the same effects as in table 1. One of these Parties would show an increase, and another, approximately stabilization instead of reductions and the third, a smaller reduction. A comparison with inventory data is not applicable for most Parties because either they did not make projections for all gases reported in the inventories or for all sources or they used different methods.

Table 7. Projected anthropogenic emissions and removals of all greenhouse gases[a] (CO_2equivalent in Gigagrams, using 1994 GWPs, time-horizon = 100 years)[b]

	Data from inventory	Data from projection		Variations
	1990 level (CO_2 equivalent in Gg)	1990 level[c] (CO_2 equivalent in Gg)	2000 level (CO_2 equivalent in Gg)	from projection (Percentage)
Australia	596 728	596 752	635 414 [d]	6.5
Austria	75 567	~ 74 600	~ 81 886 [d]	~ 9.7
Canada	564 523	504 542	558 757 [d]	10.7
Czech Republic	202 581	176 548	145 256	-17.7
Denmark	62 813	69 165	63 621	-8.0
Germany	1 218 374	1 256 500	- [d]	-
Japan	1 132 607	1 132 650	~ 1 153 336	~ 1.8
Netherlands	213 257	219 690	206 463	-6.0
New Zealand	63 997	59 764	52 041	-12.9
Norway	40 395	52 478	54 790 [d]	4.4
Spain	337 030	222 908	276 523 [d]	24.1
Sweden	41371	40 383	46 440	15.0
Switzerland	54 640	47 194	45 267	-4.1
UK	732 979	~ 738 453	~ 695 353	~ -5.8
USA	5 402 784	5 473 271	5 440 225	-0.6

[a] Figures from tables 1 to 5 have been used as the starting point for these projections. Only gases and sources and removals that were projected are included.
[b] Figures differ from those in the communications where countries did not use IPCC-1994 GWPs (time-horizon 100 years).
[c] Major differences between inventory figures and projection figures for 1990 reflect that projections were not given for all gases reported in the inventories or for all sectors, nor that temperature or electricity imports adjustments had been taken into account.
[d] Projection for *land use change and forestry* not provided.

Comments

When available data for *land use change and forestry* are aggregated with other reported emission data, seven Parties projected to be below 1990 levels by 2000. The Party that did not give figures for 2000 projected an 11 per cent decrease from 1990 to 2005. Seven Parties projected increases. This is based on adjusted figures, though the adjustments would have the same effects as in table 6. A comparison with inventory data is not applicable for most Parties because either they did not make projections for all gases reported in the inventories or for all sources and sinks or they used different methods.

136. Seven Parties provided projections for NO_x, NMVOC and CO, one for the first two, and another for 2005 only. These projections decreased from 15 to more than 50 per cent.

137. Nine Parties provided projections by sector, four for CO_2 only and one for only CH_4, N_2O and precursors for 2005. For seven Parties, CO_2 emissions from transport increased. Other trends were not evident owing to non-comparable or non-transparent data.

138. Seven Parties provided projections, some in the form of a graph, for years prior to 2000. In one projection the aggregated figure for all emissions and removals increased until 1997 before returning to the 1990 level in 2000. For a Party with its economy in transition, the baseline CO_2 emissions declined until 1994 and then started to rise again. Others showed a smoother progression to their 2000 levels, while some of them were stable until 1995, increasing thereafter.

139. Post-2000 scenarios for 10 Parties were provided for CO_2 emissions, three communications projected figures for CO_2 sources and sinks together, five gave CH_4 and N_2O projections, four projected other gases and three used GWPs. With respect to CO_2 emissions, six countries reported growth after 2000, one country reported a decrease and three countries reported possible increases or decreases under different scenarios.

C. Estimate of the total effects of policies and measures on greenhouse gas emissions and removals

140. Article 12 requires each Party to provide a specific estimate of the effects that its policies and measures will have on anthropogenic emissions by its sources and removals by its sinks. According to the guidelines a specific estimate of total effects should, to the extent possible, take into account all policies and measures implemented or committed to since the base year. This requirement has been implemented in different ways. All Parties represented total effects of policies and measures in their "with measures" projections for emissions of various gases and removals by sinks. Nine Parties gave separate quantitative estimates for the total effects of policies and measures for CO_2 emissions; some also gave figures for emissions of other gases and removals by sinks.

141. Some Parties adopted an aggregate approach and gave estimated effects of groups of policies and measures. Others also gave detailed information on their policies and measures and then aggregated them, taking into account overlaps and synergies. Yet other Parties gave estimates for some policies and measures, but did not give figures for the total. Most Parties reported major methodological problems related to such estimates. Some Parties made qualitative statements to address the issue, which was sometimes seen as the only possible way to respond. Only a few documented the methods used.

142. The range of reported estimates of total effects in 2000 was wide, reductions of between 4 and 20 per cent from baseline scenarios for CO_2 and wider for other gases, reflecting differences in policies, national circumstances and approaches to the estimates. Owing to the heterogeneous character of their information, the secretariat has been unable to present it in tables.

143. In general, most of the Parties focused on measures induced by government policies. To a limited extent, they elaborated on the effects of actions by individuals or organizations that were not induced by policies. One Party, for which energy conservation generated the bulk of estimated CO_2 reductions, said that "no distinction can be made between policy-induced and autonomous effects on energy conservation". Consequently, their estimate of the effects of these policies and measures was the difference between projections with and without energy conservation.

144. When giving their estimates, several Parties did not distinguish between policies and measures implemented or committed to before and after 1990. Some included policies and measures implemented in the 1990s in their baseline, while others included in their effect figures, policies and measures implemented earlier.

D. Summary conclusions

145. The 15 Parties made considerable efforts to communicate projections according to the Convention and the guidelines. In most cases where the guidelines used the words "should" and "encouraged", information was provided. However, only nine of the Parties gave estimates of the total effects of policies and measures, often described as very uncertain. Where information was not given, this was often due to lack of adequate methods in the reporting country.

146. The "with measures" projections reveal a different pattern for CO_2 emissions than for emissions of other gases. **The following analysis compares projected figures for 2000 with the 1990 figures used in developing the projections (three of which included "adjustments") rather than with the 1990 inventory figures, since the projections were derived from the former.**

147. For CO_2 emissions (excluding land use change and forestry) (table 1), nine Parties projected an increase to the year 2000 in the absence of additional measures. Five Parties projected stabilization or a decrease for 2000. Another Party projected only a decrease for 2005. Seven Parties projected increased "net" CO_2 removals from the land use change and forestry sector for 2000, two Parties projected stable removals and one Party, decreasing removals. (The main effect of adjustments is shown in table 1.)

148. For CH_4 (table 3), all but two Parties projected decreases, despite the fact that, in relative terms, Parties focused less attention on policies to address CH_4. No clear picture emerges for N_2O (table 4). Few Parties provided projections of other gases (table 5), but for those that did, emissions of PFCs were decreasing, while emissions of HFCs were increasing. If IPCC-1994 GWP values are used to aggregate the emission data for all gases, projected emission levels in 2000 were below 1990 levels for five Parties and above for nine Parties (table 6). One Party projected a decrease to 2005. For three of the Parties whose emissions were projected to grow, the increase was less than 2 per cent. If CO_2 removals are included (table 7), then seven Parties project decreases on a CO_2 equivalent basis.

149. In due time, it will be possible to assess the achievement of the aim of returning emissions to 1990 levels by 2000 by comparing the inventory figures for those two years. At present, a comparison of CO_2 emission projections for 2000 with inventories for 1990 suggests a somewhat greater need for additional measures than that indicated by the above analysis.

150. The projected emission levels in 2000 should not be seen as absolute predictions. They were developed on the basis of a variety of assumptions and inputs, including with regard to which policies and measures were taken into consideration. Many Parties acknowledged that additional policies and measures would have to be implemented for them to return their emissions in 2000 to 1990 levels. They indicated that policies and measures that would result in additional emission reductions were under preparation or implementation.

VII. FINANCE, TECHNOLOGY AND CAPACITY BUILDING

151. In accordance with Article 12.3 and the guidelines, all 14 Annex II Parties that submitted communications reported on actions to meet the obligations contained in Article 4.3, 4.4 and 4.5, although the level and breadth of coverage varied considerably.

152. On the basis of the information provided, it has been difficult to draw clear conclusions about the nature and level of contributions and the assistance provided by Annex II Parties to developing country Parties for the purpose of implementing the Convention. The information was not comparable in terms of figures provided and time-frames of reported expenditures. A distinction was not always drawn between activities undertaken before and after adoption of the Convention. Finally, descriptions of many activities were reported only as "environmental", reflecting the difficulty in isolating climate change mitigation or adaptation activities from broader questions of sustainable development. As a result, it has been difficult to aggregate data or to present summary tables.

A. Financial mechanism

153. Article 21 designates the GEF as the entity entrusted with the operation of the financial mechanism on an interim basis. The guidelines request Annex II Parties to provide information on contributions to the operating entity or entities of the financial mechanism.

154. Eleven of the Parties that contributed to the pilot phase of the GEF reported on these contributions. Two Parties did not mention their contributions although they were contributors. One Party indicated that it did not contribute to the pilot phase. The figures reported in the national communications are not presented here because of ambiguities in time periods and because it was not always specified whether figures included core and/or cofinancing and parallel contributions. In general, however, the figures reported for each country appear consistent with the figures published by the GEF secretariat (see table 8). Contributions from the reporting Parties constitute 68 per cent of total pilot phase funding.

Table 8. Contributions to the GEF from reporting Parties (for all focal areas)

	Pilot phase	Replenished GEF (1994-1997)	
	(millions US$)	(millions SDR)	(millions US$)
Australia	21.3 [c]	20.8	29.2
Austria	34.5 [a]	14.3	20.0
Canada	18.3 [c]	61.8	86.5
Denmark	22.8 [a]	25.1	35.1
Germany	142.4 [a]	171.3	239.8
Japan	66.9 [d]	296.0	414.3
Netherlands	52.8 [a]	51.0	71.4
New Zealand	0.0	4.0	5.6
Norway	27.4 [c]	21.9	30.7
Spain	14.1 [a]	12.4	17.3
Sweden	25.7 [a]	41.6	58.2
Switzerland	55.6 [c]	32.0	44.8
UK	60.5 [a]	96.0	134.5
USA	150.0 [b]	307.0	429.7

Source: GEF secretariat.

[a] Core fund only.
[b] Co-financing/parallel financing.
[c] Core fund and co-financing.
[d] Core fund and co-financing (grant equivalent).

Note

Contributions reported by the GEF in SDR have been converted into US dollars, based on average exchange rates for 1 November 1992 to 31 October 1993, that is, 1 SDR = US$ 1.401).

155. With regard to replenishment of the GEF (1994-1997), 12 of the Parties indicated they had made, or would make, contributions or pledges. Two Parties did not address this matter, but the GEF secretariat has confirmed that they have pledge or made contributions. Figures in table 8 are pledges or contributions as reported by GEF. The funding from the reporting Parties constitutes 82 per cent of the total for the replenished GEF.

156. It is important to note that only part of the GEF resources fund climate change activities. During the pilot phase, this amounted to 38 per cent or $281.8 million. There has, as yet, been no specific allocation of funds for climate change or other focal areas in the current phase of the GEF. The initial planning of resource use for 1995 makes some funding allocations that incorporate climate change activities without separating these from activities in other focal areas. In this context, Article 11.3 (d) provides that the COP and the entity or entities entrusted with the operation of the financial mechanism shall agree upon arrangements to determine in a predictable and identifiable manner the amount of funding necessary and available for the implementation of the Convention and the conditions under which that amount shall be periodically reviewed.

157. The guidelines request Parties to report on actions to meet the obligation contained in Article 4.3 to "provide new and additional financial resources" to meet the costs specified in that article. Approximately two thirds of the Parties mentioned "new and additional", "additional" or "expanded" resources. About half of these indicated that their contributions to the GEF were new and additional and should be seen as fulfilling this commitment.

158. The Instrument for the Establishment of the Restructured GEF ("the GEF Instrument") defines the facility as "a mechanism for international cooperation for the purpose of providing new and additional grant and concessional funding" (emphasis added). By agreement of those participating in the GEF, financing through the mechanism is to be new and additional.

159. It is difficult to draw conclusions from the communications with regard to "new and additional". There is no way to confirm that resources described as such are in fact "new and additional" and no agreed benchmark against which such verification could take place (that is, new as of when or additional to what). Moreover, the fact that a number of Parties did not refer to "new and additional resources" in their communications does not mean that their relevant financial resources could not be regarded as such.

160. A report prepared for the Commission on Sustainable Development (CSD) in February 1994[9] may shed some light on the general issue of "additionality". It summarized the current flows in official development assistance (ODA) from members of the Development Assistance Committee (DAC) of the OECD. Aggregate ODA increased in 1992 by 6.6 per cent in nominal terms, representing a small increase in real terms. Contributions by DAC countries to multilateral agencies rose by 19 per cent, mainly owing to higher contributions to the International Development Association and the regional development banks. Bilateral aid, by contrast, declined by 7 per cent in real terms in 1992. Preliminary analyses for 1993 indicate that ODA from DAC members declined from $60.8 billion in 1992 to $56.0 billion in 1993, a 6 per cent decline in real terms. Proportionately, donors' contributions to multilateral institutions fell more sharply than their bilateral programmes. The decrease in bilateral ODA was due to a decline in loans, while bilateral grants remained at the 1992 level.[10]

B. Financial resources through bilateral, regional and other multilateral channels

161. In addition to the financial mechanism, bilateral, regional and other multilateral channels may be used to transfer resources from Annex II Parties to developing country Parties for the implementation of the Convention (Article 11.5). The guidelines request Annex II Parties to report on these financial flows, specifying whether such resources are related to mitigation or adaptation.

Bilateral channels

162. All but one of the communications reported on bilateral activities, and about two thirds had a specific section on the subject. The themes most commonly mentioned were energy, capacity building, transfer of technology, adaptation, forestry and research. In this context, the following sectors were mentioned frequently:

(a) Twelve Parties described bilateral activities in renewable energy (for example, hydro, biomass, photovoltaic/solar systems and wind) and generation with low carbon fuels;

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[9] "Financial resources and mechanisms for sustainable development: overview of current issues and developments", E/CN.17/ISWG.11/1994/2, 22 February 1994.

[10] Trends in volume and allocations of Official Development Assistance, OECD/DAC Chairman's Report, October 1994, p. 78.

(b) Ten reported on activities related to energy efficiency (for example, upgrading electricity transmission lines, energy demand side management and restructuring of the electricity market (prices, subsidies, and so forth));

(c) Ten reported on forestry activities, about half of which addressed forest management; some mentioned sink enhancement and afforestation;

(d) Nine mentioned activities in energy planning; and

(e) Seven reported on activities related to climate change research including sealevel rise, monitoring, meteorological assistance, CH_4 emissions and forestry.

Regional channels

163. The discussion of regional channels was limited. About half of the communications referred to activities implemented through regional organizations (such as the regional development banks, the South Pacific Regional Environment Programme, the Organization of Eastern Caribbean States, or the Association of South East Asian Nations) or where participation in an activity was region-wide. Most activities concerned capacity building such as seminars and/or studies on climate change issues, emissions inventories, evaluation of impacts and strategic analysis of response options. Research activities were also noted.

Other multilateral channels

164. Twelve Parties discussed activities that they characterized as multilateral. The most common examples cited related to contributions to the Committee trust funds (see A/AC.237/80) and to the IPCC to support these two processes, including funding for the participation of developing countries. Other activities mentioned included:

- Contributions to activities under the Tropical Forestry Action Programme and to the International Tropical Timber Organization

- Support for the IEA/OECD GREENTIE programme

- Support through the South Pacific Regional Environment Programme for national participation in multilateral negotiations

- References to the role of multilateral development banks

- Support to the International Center for Agroforestry and the Center for International Forest Research

- Support for technology-related activities under the United Nations Industrial Development Organization

- Support for ongoing UNEP and WMO programmes

C. Transfer of technology

165. Article 4.5 addresses the transfer of, and access to, technologies and know-how. The guidelines request Annex II Parties to submit information, particularly with regard to technology transfer or access, with a delineation between governmental and private sector initiatives.

166. The references to technology transfer tended to reflect the current international discussion, especially those in the CSD. These discussions centre on mechanisms to facilitate technology transfer, such as technology centres and clearing houses, joint ventures and other types of partnerships, and on terms and levels of financing and investment.

167. Nine communications made some reference to this issue. Many discussed the approach to technology transfer and some gave examples of ongoing projects. Specific examples of activities were discussed mostly within the framework of bilateral cooperation. The areas of activity mentioned included the energy sector (developing and applying technology to coal plants or renewable energy sources and to improving energy efficiency), technology for observation and assessment in meteorology and climatology, and technology related to forest conservation and afforestation. A few communications discussed efforts to establish information-sharing facilities in order to provide information on the availability of, and access to, technology, one with the explicit intent of linking demand with supply in the private sector.

168. The role of the private sector in technology transfer was discussed in five communications. The need to create partnerships between the public and private sectors was also mentioned (for example, technologies being promoted through credit for investments).

D. Adaptation

169. Article 4 includes commitments relating to cooperation in preparing for adaptation and assistance in meeting the costs of adaptation. Six Parties addressed, either explicitly or implicitly, cooperation with developing countries relating to adaptation and vulnerability

assessment, some referring to these as elements of their development assistance or international climate cooperation programmes.

170. The bulk of the discussion of adaptation and vulnerability assessment related to specific bilateral projects which focused on activities that could be characterized for the most part as preparatory studies or capacity building. The following areas of activity were most commonly mentioned: studies of vulnerability assessment or potential impacts, including the assessment of policy options for adaptation; studies of sealevel rise; development of coastal zone management plans, and meteorological service capacity building.

E. Capacity building

171. Article 4.5 refers to the development and enhancement of endogenous capacities of developing countries. Moreover, capacity building has been identified as the first programme priority recommended by the Committee for the financial mechanism. Most of the national communications addressed this issue, either through explicit references or by describing bilateral projects that can be considered as capacity building activities. The following are noteworthy:

(a) Two thirds of the communications reported on support for country studies, including the development of inventories, the identification of mitigation and adaptation response options, and the development of plans and strategies;

(b) About half referred to general and/or managerial training activities in relation to energy, forestry, climate change impacts, technology and meteorology;

(c) About one third mentioned efforts to strengthen research capacities, including exchanges, funding and joint research efforts and a similar number referred to capacity building activities directed at meteorological services, including meteorology and climatology; and

(d) About one third referred to institution building, including the development of legislation and regulations.

172. There were few references to capacity building at the multilateral level. One communication referred to the role of the GEF in this regard, one highlighted the role of the multilateral development banks, and one noted support for WMO activities.

F. Assistance to countries with economies in transition

173. Article 4.3 and 4.4 relates to the provision of financial resources to developing country Parties. Nevertheless, eight Parties also reported on bilateral and multilateral assistance to countries with economies in transition. These efforts appeared, at least in part, to be relevant to the implementation of Article 4.5.

174. Many of the activities reported encompass elements relating to technology transfer, assessment studies or capacity building. Key sectors mentioned were: energy efficiency (subsectors: transportation, housing); country studies and inventories; policy formulation and planning; conversion of power plants to more efficient technologies; and the promotion of increased utilization of renewable energy sources. Some communications also reported on efforts to mobilize resources through credits or feasibility studies for joint ventures.

G. Summary conclusions

175. All Annex II Parties that submitted national communications have made commitments to contribute to the replenished GEF. The level of "new and additional" resources, however, cannot be determined on the basis of the communications as there is no agreed benchmark against which to measure this. Although financing through the GEF is defined in the GEF Instrument as "new and additional", only a few communications indicated explicitly that their contributions to the GEF were new and additional.

176. All Annex II Parties reported on some activities implemented through bilateral, regional or multilateral channels. It was not possible to aggregate the reported resource flows because of lack of comparable data. Much effort was reported on capacity building, especially as regards country studies, inventories, observation and monitoring. With regard to adaptation and vulnerability assessment, most of the activities could be characterized as preparatory studies.

177. The discussion on technology transfer centred on the approach to technology transfer, the access to information and technology, and to mechanisms for transfer. Discussion of specific activities was limited. Little information was provided regarding predicted and identifiable resource allocations, either bilaterally or in the context of the financial mechanism (Article 11.3(d))

VIII. IMPLEMENTATION OF OTHER COMMITMENTS AND RELATED ISSUES

A. Expected impacts of climate change, vulnerability assessment and adaptation

Expected impacts of climate change and vulnerability assessment

178. Addressing commitments under Article 4.1(b) and (e), all but one national communication discussed, in varying detail, the vulnerability of ecosystems, economic sectors and society and the expected impacts of climate change thereon.[11] The communications generally treated the expected impacts of climate change and vulnerability to climate change as a single issue.

179. Nine communications included information on a national climate change scenario (derived from existing models) which was used as a basis for assessing potential impacts and vulnerability. The uncertainties regarding the scenarios were noted, particularly the inadequacy of global models for predicting regional or national climate change. Different time-scales and key assumptions were used to predict possible temperature increases. The greatest uncertainties existed with regard to predictions of possible changes in precipitation.

180. Uncertainties with regard to the predictions of climate change were mentioned as a fundamental problem in assessing possible impacts of climate change and the consequent vulnerability of ecosystems, sectors of the economy and society. It was emphasized that improving the predictions of national or regional climate change was the essential first step. In addition, many communications mentioned that impacts and vulnerability were difficult to assess due to the complexity of the systems and the interactions among several factors. All but one of the Parties mentioned that research was being undertaken to improve knowledge of the climate system and the impacts of climate change in a variety of sectors.

181. In most cases the expected impacts and vulnerability were described qualitatively, but one national communication estimated the impacts and vulnerability in terms of extra costs that would be incurred to cope with the impacts or in terms of damage costs.

182. Coastal zones and agriculture were mentioned frequently in the discussions on expected impacts and vulnerability. Sealevel rise and increased intensity and frequency of extreme weather events could lead to increased flood risks, damage to coastal protection

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[11] "Vulnerability" and "impact" are defined as in the *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation*, WMO/UNEP, Geneva, 1994, p.3.

structures, adverse effects on sea transport and coastal erosion. Sea water intrusion could also affect water supplies and agriculture in coastal areas. Temperature and precipitation changes would affect soil processes and moisture, including availability of nutrients which could adversely affect crop quality and quantity. Carbon dioxide increase may be beneficial for some crop species.

183. Several communications also mentioned expected impacts on and vulnerability of forests, animal and plant species, biological diversity, hydrological balance, energy consumption and hydropower and water supply. The frequent discussions of health focused on, inter alia, the types, distribution and number of pathogens and vectors resulting in possible adverse effects on humans, animals and plants.

Adaptation measures

184. All Parties but one included some discussion of adaptation measures. Several mentioned the constraints imposed by of uncertainties with regard to the magnitude, timing and regional distribution of climate change, as well as the potential impacts of those changes. Eight communications reported on research to reduce the uncertainties so that appropriate and targeted adaptation strategies and measures could be developed. In some cases, such research is an integral part of adaptation strategy development. (Information regarding assistance to developing countries in the field of adaptation (Article 4.4) is included in paragraphs 169-170 above. Other activities related to cooperation in preparing for adaptation (Article 4.1(e)) were not explicitly addressed in the communications).

185. Five Parties mentioned adaptation measures other than research that are already being implemented or are being developed, such as: the modification of construction design codes to adapt to new climatic factors; investment in artificial snow-making and diversification of recreational activities in ski resorts; the taking into account of possible sealevel rise and increased weather extremes in coastal zone planning and management, including coastal defence construction, and basin-wide management of water reservoirs.

186. Approximately half of the communications mentioned possible adaptation measures to be considered in the future, including changes in urban structure, flushing of coastal areas with freshwater to prevent salt water intrusion, systematic supply of sand to eroding beaches, rescue of competitively weak species in natural ecosystems through frozen storage of seeds, and implementation of improved farming practices and use of better adapted crop species.

187. Improved forestry and wildlife management and modern support systems were mentioned as measures that, while not directly targeting adaptation to climate change, will facilitate adaptation in the future. Four communications referred to such measures.

B. Research and systematic observation

188. Pursuant to Articles 4.1(g) and 5, all Parties reported on research and systematic observation activities although the depth, coverage and level of detail varied widely.

189. Research in most countries is carried out primarily in government and recognized scientific establishments, including universities and other academic research institutions. There was limited reference to research being carried out by the industrial sector, although this could be implied from the extensive studies being carried out, particularly in the fields of energy production, transformation and use, and transportation.

190. The most common areas of research included the climate system, modelling including global circulation models, greenhouse gases and their effects on the climate system, sources and sinks of greenhouse gases with particular reference to energy production and use, agriculture, forestry and the oceans. There was one mention of climate change detection. (Research into the impacts of climate change is addressed in paragraphs 178-183 above while paragraphs 109-113 describe technology R&D efforts and socio-economic research.)

191. The scope of most research activities is largely national although all countries participate in international research efforts to a greater or lesser extent. These include active participation in the work of the IPCC, and related projects, the International Geosphere-Biosphere Programme and the Man and the Biosphere programme and the joint research for the Global Oceans Observation System (GOOS), among many others.

192. Many communications mentioned the importance of atmospheric, terrestrial and oceanic observation and monitoring networks, although in some cases not all three areas. National services participating in systematic observation and monitoring activities, where mentioned, varied from country to country and included meteorological and hydrological services and oceanographic services as well as universities and other research institutions. All countries participated in international observation and monitoring programmes, including the World Weather Watch of WMO, the Global Climate Observing System, the Global Atmosphere Watch and GOOS, among others. Several made specific mention of satellite observations. Most countries mentioned data collection and archiving activities, including involvement with International (World) Data Centres.

193. The sections of the national communications relating to research referred, in a limited number of cases, to cooperation with developing countries to improve endogenous capacities and capabilities to participate in research and systematic observation activities. This cooperation took the form of funding for research, for participation in meetings, and for collaboration among scientists, in addition to some joint research projects.

194. A number of countries mentioned expenditures on research activities but in general these were not compatible between countries and could not be aggregated.

C. Education, training and public awareness

195. Pursuant to commitments under Articles 4.1(i) and 6, the issues of public awareness, information dissemination, education, training and public participation were, in general, well documented. All Parties discussed these topics, and almost all of them reported on this issue under a separate heading or as a specific item, indicating that some priority is attached to this commitment. Most communications provided an extensive account of the initiatives undertaken in this area while the others described only a few specific projects to illustrate a general programme. (Public education campaigns designed to limit emissions are also referenced in section V above. Matters related to education and public awareness at the international level (Article 6(b)) are discussed in section VII above.)

196. Initiatives taken to incorporate scientific, policy and practical dimensions of climate change into the **education** process were reported in the area of formal education, at primary school, secondary school and university levels, in 13 communications. Primary and secondary schools were the main targets, generally through curricula reform and periodic mailings of teaching material to schools. A number of these undertakings, however, referred to general environmental information, of which only a part was related to climate change.

197. Twelve countries reported on **training** activities undertaken. Frequently mentioned were programmes providing technical training (for the most part on energy efficiency) to architects, caretakers, maintenance personnel and drivers. Accounts of managerial and scientific training were less frequent. Training programmes were usually designed directly for practitioners, although in a few cases, "train the trainer" programmes were mentioned.

198. The material in the communications relating to **public awareness** focused on campaigns to provide information on the effects of climate change, to promote the social acceptability of policies to reduce emissions and to encourage voluntary action. The majority of the information campaigns described were aimed at the general public, although a number did focus on specific groups, such as motor vehicle users, households, local authorities or farmers. Most campaigns were run by Governments, usually under the auspices of environment ministries. In a minority of cases non-governmental organizations, local authorities and utilities were reported to have organized independent campaigns. The themes of the campaigns centred mostly on the promotion of energy-efficient behaviour and the reduction of CO_2 emissions. Other areas of focus included the effects of climate change, the promotion of renewable energy resources and the protection of forests. The tools used most often were pamphlets, brochures and newsletters, although many other instruments were

mentioned, such as television and radio broadcasting, advice centres, telephone line services, fairs, seminars and billboard advertisements.

199. With regard to **public participation**, nearly three quarters of the communications described explicitly the process leading to the formulation of a national strategy or action plan to combat climate change. Most of these mentioned that constituencies other than government ministries and agencies were actively involved. Eleven Parties provided information on the drafting of their national communications. Four Parties specified that a major consultative process had been undertaken to incorporate the opinions of non-governmental organizations, the business community, local authorities and others.

200. Public participation in the form of collaborative action and partnerships between the Government and other groups was described in all the communications, although the extent of public involvement varied considerably from one communication to another. For example, one Party described its entire programme to reduce emissions as grounded in a partnership approach, whereas another reported only a few measures in the national programme illustrating such collaboration. Partnerships were most frequently described in relation to business and industry.

201. Independent initiatives of groups and organizations outside the public sector were reported less frequently than the partnerships discussed in the previous paragraph. Most schemes described were launched by the business community, although local authorities and non-governmental organizations also played an important role.

D. Integrating climate change considerations into policies and the identification and review of policies and measures leading to greater levels of emissions

202. With regard to commitments under Article 4.1(f), 10 communications made explicit, albeit brief, reference to climate change considerations in the context of **social policies** (for example, improvements in education and training, research into the socio-economic impact of climate change and health-related issues). Explicit mention of the incorporation of climate change considerations into **economic policies** was made in only a few communications. In all of the communications, however, many of the policies described to reduce emissions indicated that countries are including such considerations in economic policy-making. All Parties mentioned specifically the introduction of climate change considerations into **environmental policies**, in the form of climate change components of national environmental plans, climate change strategies and plans, or the setting up of processes and committees to address the issues. Only three Parties mentioned explicitly environmental impact assessment.

203. Under Article 4.2(e)(ii), each Annex I Party is required to "identify and periodically review its own policies and practices which encourage activities that lead to greater levels of anthropogenic emissions of greenhouse gases ... than would otherwise occur" (emphasis added). In general, explicit reference to this article was not made. Most communications, however, did provide examples and instances of changes in policies and practices (for example, the removal of subsidies, changes in agricultural policy and land use practices and changes in tax structure).

E. Other issues

204. One communication - - from a Party whose economy is in transition - - noted that Article 4.6 provides for "a certain [degree of] flexibility" when meeting its commitments, in particular with reference to modifying its projections of emissions of greenhouse gases for the year 2000. The communication did not include a request for a certain degree of flexibility; if such a request were made, the COP would have to consider the matter. No communication sought special consideration under Article 4.10.

205. Article 4.2 addresses joint implementation, while the Guidelines are silent on this issue, leaving the subject open. While recognizing that the required criteria need to be decided upon, seven communications mentioned "joint implementation", with three of these discussing the subject in some detail, and all but one making a specific linkage to the Convention. The controversy surrounding the issue was acknowledged, with three communications mentioning that action had been taken to clarify some of the concepts. Four communications referred to specific projects or "pilot projects" under way, and three others mentioned that these were being planned. Two countries described initiatives that had already been taken with regard to domestic preparation to engage in joint implementation ventures with foreign countries.

IX. THE REVIEW AND SYNTHESIS PROCESS

206. The guidelines for the preparation of first communications from Annex I Parties are quite demanding in terms of the amount of information and level of detail requested or encouraged. Parties made significant efforts to follow the guidelines while recognizing that it many cases it will take more time and experience to be able to implement them fully. Nonetheless, the initial technical analysis has revealed some potential problem areas and issues where further precision or clarification of the guidelines might be useful. These relate largely to enhancing the transparency and comparability of information.

207. Time did not permit the undertaking of a systematic review of the guidelines and the identification of potential improvements or of supplementary presentational devices such as standard tables, questionnaires or electronic formats. The Committee may wish to consider asking the interim secretariat to undertake such a review and to prepare a report on the matter for consideration by the Subsidiary Body for Scientific and Technological Advice. In addition to enhancing transparency and comparability generally, a review could examine issues such as:

(a) Gases to be reported, definition of source/sink categories, reporting of removals and treatment of "adjustments", such as for climate variations and energy trade;

(b) Providing more precision on the type of background and supporting information to be supplied;

(c) The estimation of the effects of policies and measures, both individually and overall;

(d) The level of detail required for reporting on policies and measures including how the most significant ones can be identified;

(e) Additional reporting conventions on data presentation, time frames and methods descriptions;

(f) Reporting requirements with regard to the characterization of new and additional resources; and

(g) The inclusion of commitments not explicitly addressed in the guidelines.

208. Several of the above issues will require the further development of methodologies. In this context, it will be important to work closely with the IPCC and other relevant bodies.

209. In-depth reviews of the individual national communications will continue through 1995, subject to confirmation by COP 1. They will permit a number of the issues identified in the body of the present document to be further addressed. In the course of the initial technical analysis, it was apparent that an opportunity to seek additional information from, and to discuss any problems with, officials from the reporting Governments would contribute to better understanding of the communications and to improved comparability of information. Confirmation with Governments of the information in the database developed for the review of policies and measures would result in an improved analytical tool. This should also result in an improved basis for the second synthesis.

Annex

INVENTORIES OF ANTHROPOGENIC EMISSIONS AND REMOVALS IN 1990: TABLES

General notes to the tables

In some cases, the figures presented in the tables do not correspond to those found in the communications. To the extent possible, such cases are explained in the notes to the tables, with the exception of differences resulting from rounding due to data input and processing. Differences have arisen from corrections of typographical and calculation errors or omissions, the incorporation of data communicated in the course of the review and the presentation (for consistency and comparative purposes) of subtotals and totals not provided in the communications.

Some of the differences are due to the fact that, in order to ensure consistency and comparability of results, the secretariat had to convert some of the estimates reported so that they concurred with the guidelines. Such changes included subtraction of emissions from bunker fuels and "electricity import corrections".

Blanks in the tables refer to either an absence of quantitative information or to the fact that only qualitative information was provided. The interim secretariat has chosen to leave the spaces blank in order not to complicate the reading of the tables. The figure "zero" appears in the tables only when reported as such by the Parties.

Table A.1. Anthropogenic CO_2 emissions, excluding land use change and forestry, 1990 (Gigagrams)

	Energy		Industrial processes	Other **	Waste	Total
	Fuel combustion*	Fugitive fuel emissions				
Australia	277 987	4 086	6 892			288 965 [a]
Austria	57 100		2 100 [b]			59 200
Canada	418 947	15 756	21 224		1 514	457 441
Czech Republic	162 506	0	6 824		184 [c]	169 514 [a]
Denmark	50 934		1 166			52 100
Germany	982 805	638	29 000			1 012 443
Japan	1 075 360		53 000		45 000 [d]	1 173 360
Netherlands	164 800		1 900		900	167 600
New Zealand	22 769	271	2 490			25 530 [a]
Norway	26 967	1 694	6 494	297	81 [e]	35 533
Spain	222 908	0	35 263	0	2 483 [d]	260 654 [a]
Sweden	55 122	53	4 972	834 [f]	275 [e]	61 256 [a]
Switzerland	40 800	0	2 100	0	700	43 600 [a]
UK	562 148	5 675 [g]	13 505 [h]		2 750 [d]	584 078
USA	4 895 432	6 560	55 030 [i]			4 957 022 [a]
Total	9 016 585	34 733	241 960	1 131	53 887	9 348 296

* See notes to table 2. ** Includes source/sink categories *solvent use* and *agriculture*. In the light of the different ways of reporting used by Parties, emissions from *land use change and forestry* were excluded from this table for comparative and consistency purposes. Emission estimates were provided for the following source/sink categories for which no IPCC default methods exist: production of iron and steel, aluminum, other non-ferrous metals, ammonia, soda ash, lime, glass, fertilizer, other organic chemicals and CO_2 manufacture, limestone use and flue gas desulphurization and *solvent use*.

Notes

[a] These Parties originally included *land use change and forestry* in their total CO_2 estimates.
[b] Emissions from iron and steel were included in energy and transformation industries.
[c] No details provided as to whether or not biogenic CO_2 emissions were included.
[d] Parties deviated from IPCC Guidelines by including CO_2 emissions from organic waste combustion, aerobic, organic carbon in landfills, dumps, sludge or compost facilities in national total.
[e] No details provided as to whether or not CO_2 emissions from organic waste combustion, aerobic, organic carbon in landfills, dumps, sludge or compost facilities were included in national total.
[f] Party deviated from IPCC Guidelines by including biogenic emissions from *agriculture* in national total.
[g] Povisional data for 1991 emissions from cold vents from offshore platforms were provided during the review and added by the secretariat to the related emission figures in the UK supplementary submission dated 24 August 1994.
[h] Includes incineration and landfill gas flaring.
[i] Non-ferrous metal emissions included under non-fuel industrial uses in *energy*.

Comments

Aggregate 1990 CO_2 emissions from reporting Parties were estimated at 9,348,296 Gg. Fuel combustion was the largest source of emissions, representing 97 per cent of total CO_2 emissions. *Industrial processes* accounted for 2.6 per cent of total CO_2 emissions. The remaining 0.4 per cent came from other source/sink categories. It should be noted that the definition of *industrial processes*, *waste* and energy consumption differed across Parties, which might lead to differences when comparing the relative importance of various categories. For example, CO_2 emissions from iron and steel were either included in *industrial processes* or *energy*, and emissions from fossil fuel feedstocks as part of emissions from *energy*, *industrial processes* or *waste*. For 11 Parties, CO_2 emissions from fuel combustion represented more than 90 per cent of the total CO_2 emissions.

For two Parties, the share of emissions from *industrial processes* was higher than for most other Parties where they represented less than 5 per cent of total CO_2 emissions. Emissions from *solvent use* and *agriculture* were addressed by two Parties. While CO_2 emissions from *waste* remained small for the majority of the Parties (less than 2 per cent of total emissions), they reached 4 per cent for one Party, where they were mainly due to waste incineration and might possibly be explained by the inclusion of biogenic CO_2 emissions, which is in contradiction to the IPCC Guidelines. It was unclear whether a number of other Parties had included such emissions or not.

Table A.2. Anthropogenic CO_2 emissions from fuel combustion, 1990 (Gigagrams and percentage of total by Party)

	Energy and transformation industries		Industry		Residential, commercial/ institutional		Transport		Other		Total
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Australia	16 0053	58	32 568	12	8 351	3	68 358	25 [a]	8 657	3	277 987
Austria	13 700	24 [b]	12 300	22 [b]	12 100	21	16 200	28	2 800	5	57 100
Canada	137 776	33	71 960	17	66 780	16	139 300	33	3 131	1	418 947
Czech Rep.	117 914	73		0 [c]	32 007	20	7 637	5	4 948	3	162 506
Denmark	26 435	52 [d]	5 964	12	6 487	13	11 241	22	807	2	50 934
Germany [e]	436 062	44 [f]	169 255	17	193 137	20	158 541	16	25 810	3	982 805
Japan [g]	387 692	36 [h]	296 167	28	126 201	12	206 800	19	58 500	5	1 075 360
Netherlands	51 400	31 [i]	33 400	20	28 700	17	26 900	16	24 400	15 [j]	164 800
New Zealand	6 832	30	4 334	19	1 699	7	8 731	38	1 173	5	22 769
Norway	7 481	28	3 023	11	2 357	8	13 249	49	857	3	26 967 [k]
Spain	78 385	35	52 291	23			63 306	28 [l]	28 927	13 [m]	222 909
Sweden	7 041	13	23 092	42			13 446	24	11 543	21 [m]	55 122
Switzerland	1 300	3 [n]	5 700	14	18 100	44 [o]	15 300	38 [o]	400	1	40 800
UK	238 604	42 [p]	94 851	17	110 342	19	115 661	21 [q]	2 688	0	562 146
USA [g]	1 742 471	36	1 065 905	22	551 002	11	1 502 626	31	33 428	1 [r]	4 895 432
Total	3 413 146	38	1 870 810	21	1 157 265	13	2 367 296	26	20 8069	2	9 016 584

Notes

[a] Military transport is included under "other" *energy* (fuel combustion).
[b] Includes waste incineration for the production of energy, without details as to whether or not biogenic CO_2 emissions were included.
[c] Emissions from energy in industry under energy and transformation industries.
[d] The electricity import correction of 6253 Gg was subtracted by the secretariat from the subtotal given in the communication.
[e] Emissions data in Gg was provided during the review.
[f] Includes waste incineration for the production of energy.
[g] Estimates communicated during the review include statistical difference (9,000 Gg).
[h] Party deviated from IPCC Guidelines by including emissions from biomass burned for energy in *energy* total because biomass material used is imported.
[i] Party also provided temperature adjusted total energy emissions of 171,200 Gg, not reported in this table.
[j] Includes actual emissions from agriculture and forestry (8,600 Gg) as well as feedstocks (14,800 Gg) and statistical difference (1,000 Gg).
[k] Figure corrected during the review.
[l] Includes international shipping in coastal waters and international aircraft ground movements and landing and take-off cycle.
[m] Includes residential, commercial/institutional.
[n] Includes agriculture and forestry.
[o] Emissions from bunker fuels (2,100 Gg) have been subtracted by the secretariat from the subtotal given in the communication.
[p] Provisional data for 1991 emissions from fuel gas use from offshore platforms were provided and added by the secretariat to the related emission figures given in the UK supplementary submission dated 24 August 1994.

[9] Provisional data for emissions from international aircraft ground movements and landing and take-off cycle, as well as coastal shipping were provided during the review and subtracted by the secretariat from the related emission figures in the UK supplementary submission dated 24 August 1994.

[10] Emissions from energy in agriculture and forestry were not estimated; emissions from *energy* in the Party's territories are included.

Comments

Although energy and transformation industries was identified as the largest source of CO_2 emissions from fuel combustion, the sectoral analysis of CO_2 emissions showed important differences between Parties. For eight Parties emissions from energy and transformation industries represented 24 to 38 per cent of CO_2 emissions from fuel combustion; for five Parties, emissions were above 38 per cent. For one Party such emissions were even higher owing to the inclusion of emissions from industry in energy and transformation industries. For two Parties, energy and transformation industries represented less than 15 per cent of total emissions from fuel combustion. This could be explained by the Parties' reliance on nuclear and hydro-power generation and/or importation of electricity.

The emission profiles in the industrial sector were more homogeneous and represented 12 to 28 per cent of emissions from total fuel combustion for 12 Parties. For one Party this sector was the largest source of emissions from fuel combustion. For five Parties, transport was the largest source of fuel combustion emissions. For most Parties, such emissions represented 16 to 33 per cent of total emissions from fuel combustion. For one Party with an economy in transition, transport appears to account for only 5 per cent of fuel combustion emissions (explained by the higher importance of public transport systems and smaller number of individual cars). For three Parties, transport represented more than 35 per cent of total emissions and for one Party it was as high as 49 per cent of total emissions. Both cases could be explained by the lower share of energy and transformation industries.

The definition of residential, commercial/institutional and other energy (including agriculture and forestry) varied amongst the Parties. For 10 Parties, the residential category contributed more to CO_2 emissions than commercial/institutional. For nine Parties, these categories represented more than 11 per cent of fuel combustion emissions.

The share of "other" was small except in two cases where it encompassed residential and commercial/institutional emissions and in one case where it included feedstocks.

Figure A.1. Distribution of CO_2 emissions by sub-source category

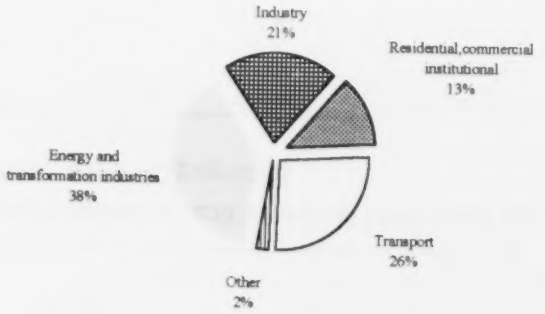


Table A.3. Anthropogenic emissions and removals from land use change and forestry and impact on total CO_2 emissions, 1990 (Gigagrams)

	Emissions	Removals	Land use change and forestry	National CO_2 emissions without land use change and forestry *	National CO_2 emissions with land use change and forestry
	A	B	C = A + B	D	E = C + D
Australia	156 293 [a]	-25 450 [a]	130 843	288 965	419 807
Austria [c]				59 200	59 200 [d]
Canada			-282	457 441	457 159 [d]
Czech Republic			-2 280	169 514	167 234
Denmark			-2 600	52 100	49 500 [d]
Germany			-20 000	1 012 443	992 443 [d]
Japan			-90 000 [e]	1 173 360	1 083 360 [d]
Netherlands			-120	167 600	167 480 [d]
New Zealand	1 255 [a]	-17 971	-16 716	25 530	8 814
Norway [f]	16 900	-29 100	-12 200	35 533	23 333 [d]
Spain	35 956 [a]	-40 134	-4 178	260 654	256 477
Sweden	75 434	-109 802	-34 368	61 256	26 888
Switzerland	5 317	-10 561 [b]	-5 244	43 600	38 356
UK [f]	1 833 [b]	-9 167	-7 284	584 078	576 794 [d]
USA			-436 000	4 957 022	4 521 022
Total	292 988	-242 185	-500 429	9 348 296	8 847 867

* See table A.1.

This table summarizes information on the land use change and forestry source/sink category. It aims to present data provided in a consistent and coherent manner, taking into account the different ways in which Parties have reported information for this category. The presentation of this table should improve as the availability of related data increases. Emission estimates were provided for the following sub-source/sink categories not addressed by the IPCC Guidelines: peat extraction, drainage of wetlands and deep peats.

Notes

[a] Emissions from forest clearing and on-site burning.
[b] Includes sequestration from grassland conversion (-17450 Gg) and managed forests (-8000 Gg).
[c] Category not estimated by the Party, but thought to be small.
[d] These Parties originally excluded *land use change and forestry* in their total CO_2 estimates.
[e] Includes sequestration in wood products (-10000 Gg) which, as recommended by the IPCC Guidelines, should not be reported as removals unless a net increase in stocks of forest products can be documented.
[f] Includes CO_2 emissions from biomass fuels.
[g] Estimate corrected during the review.
[h] Includes sequestration in wood products (-550 Gg) which, as recommended by the IPCC Guidelines, should not be reported as removals unless a net increase in stocks of forest products can be documented.
[i] An estimate of (0 +/- 1883 Gg) from conversion of grasslands to cultivated lands was also provided but not included in this table.
[j] Emissions from peat extraction, drainage of wetland and deep peat.

Comments

The largest carbon removal and reservoir was reported in the "managed forests" sub-source/sink category by 13 Parties. For four Parties, emissions from this sub-source/sink category could also be identified. Two Parties reported emissions from forest clearing and on-site burning, and one Party reported emissions from peat extraction and drainage of wetland and deep peats. Seven Parties included the *land use change and forestry* subtotal in their national CO_2 emissions.

Sinks addressed in the communications reviewed also included grassland management. One Party reported natural sinks (sedimentation in fresh water and estuaries and forest soils), which are not considered in the IPCC Guidelines. Many Parties emphasized the large uncertainty associated with emissions/removals estimates from forest soils, as well as the difficulty in estimating and differentiating natural and anthropogenic emissions and removals. Some Parties might have underestimated their removals estimates by excluding branches and roots.

Among the 14 Parties that estimated the *land use change and forestry* source/sink category, only one reported net emissions arising from deliberate burning of biomass used as a land management tool. A comprehensive analysis of emissions and removals was unfeasible due to the lack of information reported. However, for the 13 Parties that reported a net removal, the *land use change and forestry* category did not offset the CO_2 emissions (excluding *land use change and forestry)* by more than seven per cent. Considering each Party individually, removals offset CO_2 emissions (excluding *land use change and forestry*) by more than 30 per cent for three Parties, by 5 to 12 per cent for four Parties, and by less than 5 per cent for six Parties.

Table A.4. Anthropogenic emissions of CH_4, 1990 (Gigagrams and percentage of total by Party)

	Energy				Agriculture				Waste		Other***		Total
	Fuel combustion		Fugitive fuel		Livestock*		Other**						
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Australia	28		1 026	16	3 005	48	396	6	1 390	22	397	6	6 243
Austria	24	4	92	15	259	43			228	38			603
Canada	29	1	1 293	41 [a]	979	31	0		803	26	39	1	3 143
Czech Republic	59	7	404	46	173	20			150	17	91	10	877
Denmark	11	3 [b]	11	3	262	65			122	30			406
Germany	228	4	1 539	25	2 043	33			2 397	39	11		6 218
Japan	25	2	100	7	520	38	267	19	465	34			1 377
Netherlands	28	3	149	14	508	48			382	36			1 067
New Zealand	28	1	33	2	1 618	77 [c]			433	21 [d]			2 112
Norway	17	6	13	4	91	31			167	58	1		289 [e]
Spain	74	3	684	32	772	36	115	5	494	23	4		2 143
Sweden	33	10	0		196	60			100	30	0		329
Switzerland	2	1 [f]	9	3	215	78	0		48	18 [f]	[f]		274 [f]
UK	74	2 [g]	1 237	26	1 538	32			1 971	41	1		4 821
USA	613	2 [h]	7 641	28	8 088	30	508	2	10 150	38			27 000
Total	1 273	2	14 230	25	20 267	36	1286	2	19 301	34	544	1	56 901

* Includes enteric fermentation and animal wastes. ** Includes rice cultivation, agricultural soils, agricultural waste burning and savannah burning. *** Includes *solvent use*, *industrial processes* and *land use change and forestry*. Emission estimates were provided for the following source/sink categories not addressed by the IPCC Guidelines: *industrial processes*, including iron and steel manufacturing, carbon black production and industrial incineration, inorganic chemical (carbide) manufacture, as well as compost, food processing, and sewage sludge from landfills.

Notes

[a] Figure corrected during the review.

[b] The electricity import correction of 0.1 Gg was subtracted by the secretariat from the subtotal given in the communication.

[c] Includes 118 Gg from animal waste. The estimate presented in the communication was <118 Gg.

[d] Includes 296 Gg from "other" (primary production processing). The estimate presented in the communication was <296 Gg.

[e] Estimate corrected during the review.

[f] Energy and transformation industries, industry, commercial/institutional, residential, agriculture and forestry, biomass burned for energy, *industrial processes*, waste incineration for the production of energy were included in VOC emissions estimates.

[g] Provisional data for emissions from international aircraft ground movement and landing and take-off cycle, as well as coastal shipping, were provided during the review and subtracted by the secretariat from the related emission figure given in the UK supplementary submission dated 24 August 1994.

[h] Includes emissions from Party's territories.

Comments

Agriculture (enteric fermentation and animal waste) and *waste* (landfills) were identified as the largest sources of CH_4 emissions, followed by fugitive fuel which also represented a significant share of total CH_4 emissions for most Parties. All Parties but one addressed these three major categories.

Livestock was the most important source of CH_4 emissions for nine Parties and it accounted for more than 40 per cent of total emissions for seven Parties. It was lower than 30 per cent for one Party and over 75 per cent for two Parties.

Rice cultivation represented a significant source of CH_4 emissions for one Party. Some Parties also reported emissions from agricultural waste, residue and savannah burning.

Waste was the second largest contributor to CH_4 emissions, and the most important source of CH_4 emissions for four Parties. The share of *waste* varied between 30 and 40 per cent of total emissions for seven Parties, and between 20 and 30 per cent for four Parties. All but two Parties gave estimates for wastewater.

Emissions from fugitive fuel which are linked to economic activities in oil/gas or coal production were less homogeneous across Parties. For two Parties, fugitive fuel was the largest source of total CH_4 emissions: its share of total emissions exceeded 25 per cent for six Parties, varied between 14 and 16 per cent for three other Parties, and represented less than 10 per cent for six Parties.

Information was scarcer on emissions from *industrial processes*, which were addressed by six Parties. None of the Parties reported emissions from *solvent use*, and four presented emissions from *land use change and forestry*. For one Party, the contribution of the latter represented about 10 per cent of its total CH_4 emissions.

Figure A.2. Distribution of CH_4 emissions by source category

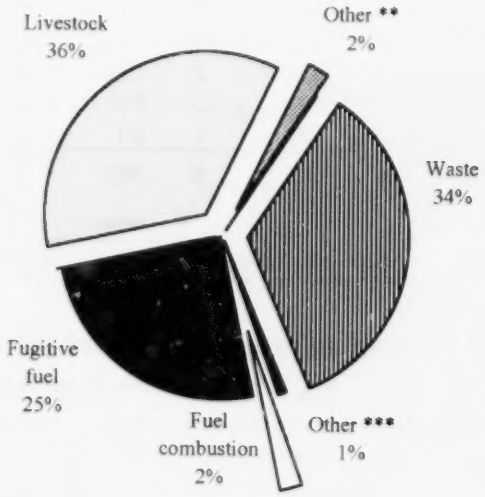


Table A.5. Anthropogenic emissions of N_2O, 1990 (Gigagrams and percentage of total by Party)

	Energy				Industrial processes		Agriculture		Waste		Other*		Total
	Transport		Other										
	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)	%	(Gg)
Australia	2.3	4	1.3	2	0.8	1	52.4	87			3.4	6	60.2
Austria	0.5	10	0.9	19	1.4	30	2.0	42					4.8
Canada	35.5	39	12.1	13	31.3	34	10.7	12	0.0		1.6 [a]	2	91.2
Czech Republic	1.0	2	19.0	48	3.0	7	2.0	5	0.0		16.0	3	41.0
Denmark	0.4	4	1.3 [b]	13			8.5	83					10.2
Germany	9.0	4	24.0	11	100.0	45	80.0	36	4.0	2	6.0	3	223.0
Japan	13.0	27	8.6	18	15.0	32	4.7	10	6.0	13			47.3
Netherlands	5.4	9	0.7	1	16.3	27	22.1	37	4.1	7	10.9 [c]	1	59.5
New Zealand	5.2	63	2.5	30				[d]	0.6	7			8.3
Norway	1.0	6	1.5	10	6.7	43	6.4	41	0.0				15.6
Spain	2.3	2	18.6	20	10.4	11	63.3	67	0.1	0	0.0		94.7
Sweden	0.4	3	4.2	28	2.7	18	7.9	52					15.2
Switzerland	0.8	3	0.7	2	0.4	1	26.7	93			0.0		28.6
UK	8.0	7	3.0	3	80.0	73	18.4	17					109.4
USA	92.3	22	35.1 [e]	9	96.1	23	187.9	46					411.4
Total	177.1	15	133.5	11	364.1	30	493.0	40	14.8	1	37.9	3	1 220.4

* Includes *solvent use* and *land use change and forestry*. Emission estimates were provided for the following source/sink categories not addressed by the IPCC Guidelines: *solvent use*, non-fertilizer induced emissions from agricultural soils, polluted inland and coastal waters, wastewater treatment, caprolactam production and animal wastes.

Notes

[a] Figure confirmed during the review.

[b] The electricity import correction of 0.2 Gg was subtracted by the secretariat from the subtotal given in the communication.

[c] Emissions from polluted inland and coastal water were reported as an additional source/sink category.

[d] A range of 1 to 37 Gg was provided, but not included in the total reported in the current table.

[e] Emissions from the Party's territories were not estimated.

Comments

Agriculture (mostly fertilizer use) was the largest source of N_2O emissions followed by *industrial processes* (chemicals), transport and "other" energy. N_2O emission estimates were not as accurate as estimates of the other two main greenhouse gases. The level of confidence associated with aggregate data was therefore lower. Comparison across Parties was difficult due to the lack of homogeneity between the communications.

Different assumptions and definitions for source/sink categories were used, and the coverage of categories varied greatly amongst the Parties. Most Parties rated the quality of emission estimates as low for the *agriculture* and *waste* categories, and medium for the *energy* and *industrial processes* categories. For these reasons, the interpretation of data presented in the table has been difficult. Emission profiles varied greatly across Parties, reflecting both the uncertainties associated with N_2O emission estimates and varying national circumstances. All Parties addressed N_2O emissions from *agriculture*, which represented more than 30 per cent of total emissions for 10 Parties. For a few Parties, emissions from animal wastes contributed significantly to total agricultural emissions. For three Parties, *industrial processes* was the largest source of N_2O emissions and contributed more than 40 per cent to total emissions. The contribution of transport to total emissions exceeded 20 per cent for four Parties. For one Party, this might be explained by the non-inclusion of emissions from *agriculture*, for which a range was reported. Finally, the "other" energy category was the largest contributor to N_2O emissions in one case, which might be explained by the small contribution of other categories.

Figure A.3. Distribution of N_2O emissions by source category

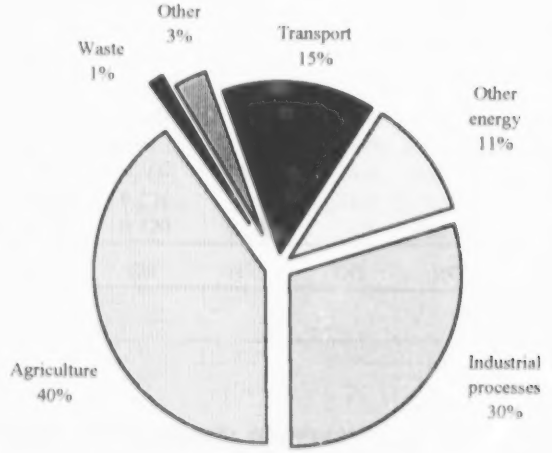


Table A.6. Anthropogenic emissions from international bunkers, 1990 [a]
(Gigagrams)

	CO_2	CH_4	N_2O	CO	NO_x	NMVOC
Australia	6 281	0.130	0.07	6.8	70.81	2.28
Canada	5 632	0.291	0.60	37.8	17.70	10.70
Denmark	4 974	0.100	0.10	17.3	71.20	2.70
Germany	8 000		0.00	155.0	37.00	16.00
Japan	31 000					
Netherlands	40 400					
New Zealand	2 398	1.100	2.20		44.10	
Norway	1 800	0.400	0.10	2.9	32.80	0.10
Sweden	4 190	1.300	0.04	44.0	60.00	15.00
Switzerland	2 100					
UK [b]	28 980	0.600		65.8	303.00	5.80
USA	22 600					
Total	15 8355	3.921	3.11	263.8	636.61	52.58

Notes

[a] Austria, the Czech Republic and Spain did not report emissions from bunker fuels.
[b] Provisional estimates provided during the review.

Comments

Twelve Parties provided emissions estimates from bunker fuels. In accordance with the guidelines, 11 of these Parties provided such information in a separate category and did not include them in total national emissions. One Party included emissions from bunker fuels in its total but also reported the corresponding figure separately. For the majority of Parties, emissions from bunkers represented 5 to 19 per cent of national CO_2 emissions and 15 to 19 per cent of national NO_x emissions. For one Party, CO_2 emissions from bunker fuels represented 24 per cent of its national CO_2 emissions.

For the 12 Parties that reported CO_2 emissions from bunker fuels, such emissions represented 1.5 per cent of their energy-related emissions. The reporting of emissions from bunker fuels of gases other than CO_2 was incomplete. However, aggregate emissions of such gases appeared to be negligible compared with aggregate energy-related emissions. The emission ratios between CO_2 and other gases sometimes varied up to a factor of 100.

Table A.7. Anthropogenic emissions of other greenhouse gases, 1990 [a] (Gigagrams)

	HFCs			PFCs		SF_6
	HFC 134a	HFC 23a	HFC 152a	CF_4	C_2F_6	
Australia				0.580	0.0400	
Canada [b]				1.400	0.1440	
Germany				1.000	0.1500	0.500
Netherlands		0.00		0.516	0.0516	
New Zealand					0.100	
Norway			0.003	0.369	0.0160	0.092
Sweden		0.00			0.060	0.040
UK				0.274	0.0280	
USA	0.5	5.52	0.300	2.70[b]		

Notes

[a] Austria, the Czech Republic, Denmark, Japan, Spain and Switzerland did not report emissions for these gases.

[b] Estimates provided during the review.

Comments

The guidelines encouraged Parties to provide emission estimates and information on "other" greenhouse gases. However, the information provided was scarce both in terms of Parties' reporting estimates and of gases addressed. Several Parties recognized that consumption of HFCs will increase.

The IPCC 1994 Special Report provides GWPs for 12 HFCs and for four PFCs. Of these, some Parties reported estimates for three HFCs and two PFCs. In addition, three Parties provided information for SF_6.

Table A.8. Anthropogenic emissions of precursor gases, 1990 (Gigagrams)

	CO	NOx	NMVOC
Australia	26 074	1 874	2 236
Austria	1 683	225	415
Canada	10 225 [a]	2 090 [a]	2 104
Czech Republic	690	856	218
Denmark	770 [b]	269 [c]	165 [d]
Germany	10 768	2 944 [e]	2 978
Japan	2 809	1 898	2 060
Netherlands	1 029	575	459
New Zealand		145	
Norway	940	230	251
Spain	4 951	1 247	1 119
Sweden	1 612	374	539
Switzerland	430	184 [f]	297
UK	6 683 [g]	2 722 [g]	2 683 [g]
USA	82 674	21 362 [h]	19 123
Total	15 1338	36 995	34 647

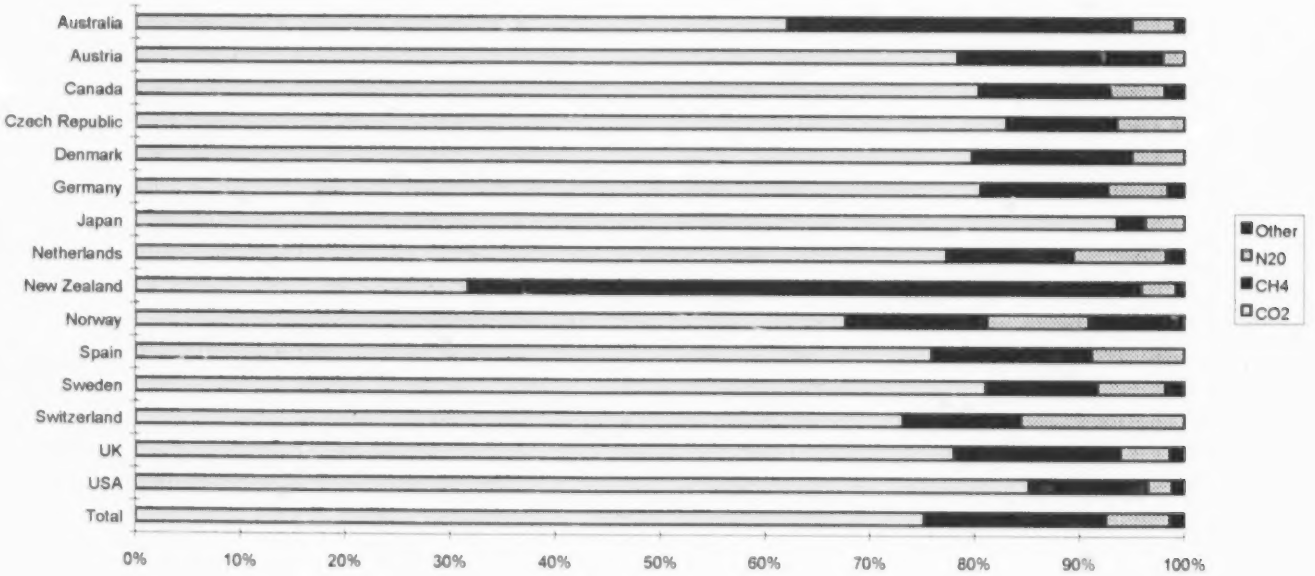
Notes

[a] Estimates corrected during the review.
[b] The electricity import correction of 0.7 Gg was subtracted by the secretariat from the subtotal given in the communication.
[c] The electricity import correction of 24 Gg was subtracted by the secretariat from the subtotal given in the communication.
[d] The electricity import correction of 0.1 Gg was subtracted by the secretariat from the subtotal given in the communication.
[e] Estimates from the Party expressed as N_2O.
[f] Non-ferrous emissions reported as being < 0.1 have not been included in this table.
[g] Provisional data for emissions from international aircraft ground movement and landing and take-off cycle, as well as coastal shipping were provided during the review and subtracted by the secretariat from related emission figures in the UK supplementary submission dated 24 August 1994.
[h] Emissions from the Party's territories were not estimated.

Comments

The guidelines encouraged Parties to provide information on ozone precursors. However, reporting of related emissions estimates varied greatly, making comparison across Parties difficult. All Parties reported emission estimates for the precursor gases, with the exception of one Party, which only reported estimates for NO_x. Information provided was limited for the *agriculture*, *land use change and forestry* and *waste* source/sink categories; the contribution of these sources to total aggregate emissions was small in comparison to those from fuel combustion. For the three gases, the largest source of emissions came from the transport sub-source/category, followed by other energy activities for CO and NO_x. The importance of *solvent use* as a major source of NMVOC was also confirmed.

Figure A.4. Relative contribution of different greenhouse gases by Party *



Notes

*Excludes *land use change and forestry*.
Other includes PFCs, HFCs, and SF_6.
IPCC-1994 GWP values with a time-horizon of 100 years, previously unavailable, were used by the secretariat for comparative purposes.
New Zealand reported emissions for PFCs of 0.1 Gg. The secretariat has assumed that approximately 5 per cent of these emissions are from C_2F_6 and the remaining 95 per cent from CF_4.

Comments

CO_2 was the most significant anthropogenic greenhouse gas representing 75 per cent of total emissions reported.

For 13 Parties, CO_2 contributed more than 70 per cent of total greenhouse gas emissions. The relative importance of other gases varied from Party to Party. For one Party, the contribution of CH_4 was larger than that of CO_2. In another case, the importance of other gases was higher than for any other Party because of aluminium smelting.